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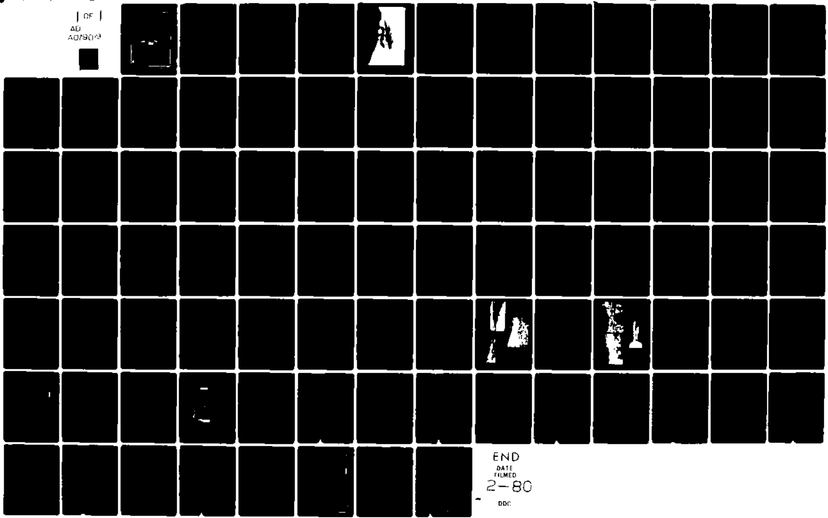

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LEVEL

SUSQUEHANNA RIVER BASIN
BLACK MOSHANNON CREEK, CENTRE COUNTY

PENNSYLVANIA

KEPHART DAM
NDS I.D. No. PA-00447
PENNDER I.D. No. 14-89

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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Contract No. DACW31-79-C-0013

PREPARED FOR

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

PREPARED BY

GAI CONSULTANTS, INC.
570 BEATTY ROAD
MONROEVILLE, PENNSYLVANIA 15146

MARCH 1979 /7

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

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PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

ABSTRACT

Kephart Dam: NDS I.D. No. PA-00447

Owner: Pennsylvania Department of Environmental Resources (PennDER)

State Located: Pennsylvania (PennDER I.D. No. 14-89)

County Located: Centre County

Stream: Black Moshannon Creek

Inspection Date(s): 13, 14 November 1978

Inspection Team: GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

Based on a visual inspection, past performance, and available engineering data, the facility is considered to be in good condition. The facility is capable of passing and/or storing the flow resulting from a flood of PMF intensity without overtopping, consequently, the spillway is considered adequate.

It is recommended that the owner:

(a) Have the embankment crest surveyed and infill any low spots to restore the embankment section to its design elevation (1874.0).

(b) Extend the riprap protection to the top of the dam along the emergency spillway-embankment junction to provide slope protection in the event the emergency spillway should discharge at or near full capacity.

(c) Develop a warning system to provide for the notification of temporary downstream residents should hazardous conditions develop.

GAI Consultants, Inc.

Bernard M. Mihalcin, P.E.

Approved by:

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

REGISTERED PROFESSIONAL
BERNARD M. MIHALCIN
ENGINEER
20371-E

(15) DACW31-79-C-0013

(11) 11 Mar 79

(12) 79

Date 16 March 79

Date 8 Apr 79

(6) National Dam Inspection Program. Kephart Dam (NDI-ID PA-00447, PennDER-ID 14-81) Susquehanna River Basin, Black Moshannon Creek, Centre County, Pennsylvania. Phase I Inspection Report.

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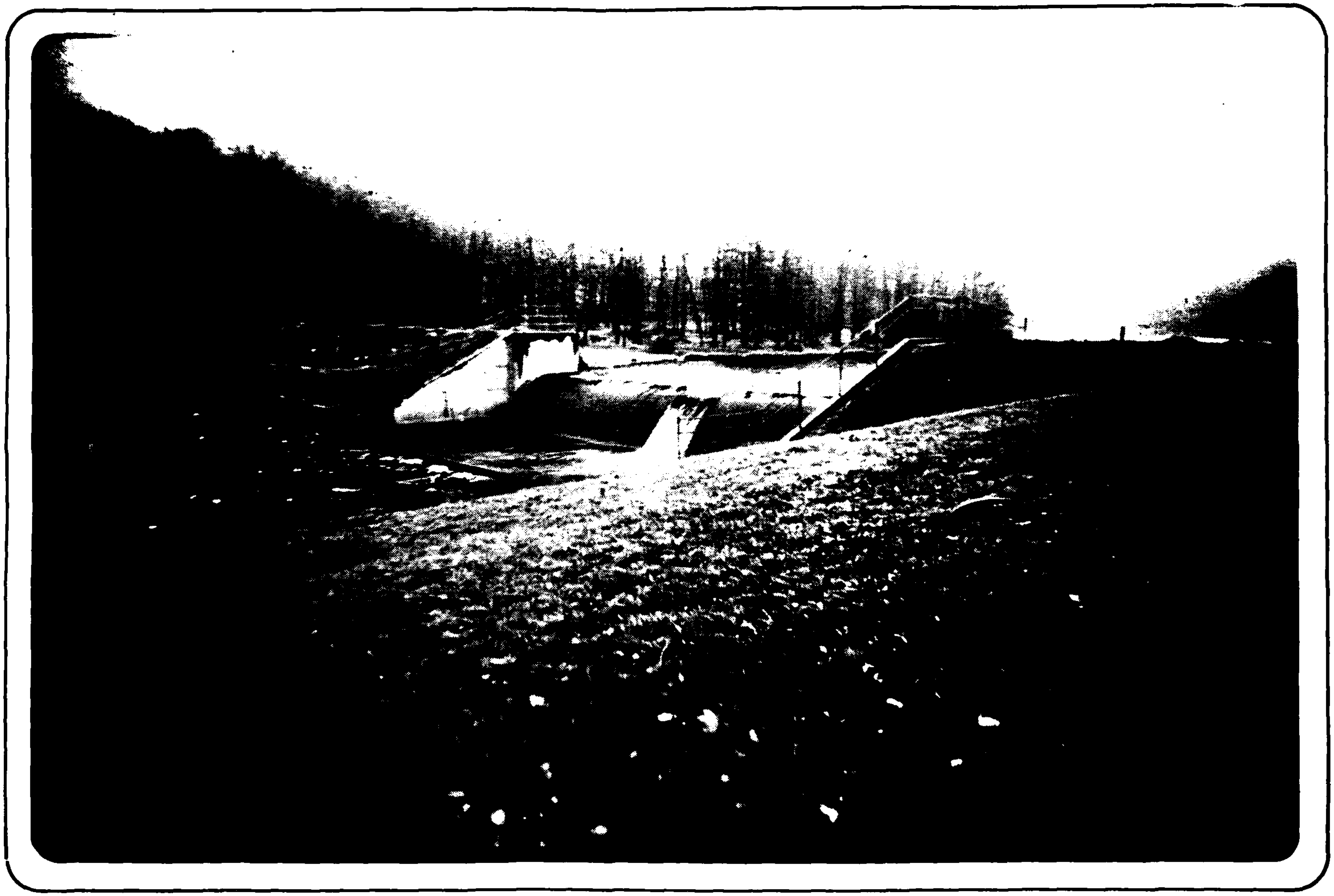

OVERVIEW PHOTOGRAPH

TABLE OF CONTENTS

Page

PREFACE i

ABSTRACT ii

OVERVIEW PHOTOGRAPH iv

TABLE OF CONTENTS v

SECTION 1 - GENERAL INFORMATION 1

- 1.0 Authority 1
- 1.1 Purpose 1
- 1.2 Description of Project 1
- 1.3 Pertinent Data 2

SECTION 2 - ENGINEERING DATA 6

- 2.1 Design 6
- 2.2 Construction Records 7
- 2.3 Operational Records 8
- 2.4 Other Investigations 8
- 2.5 Evaluation 8

SECTION 3 - VISUAL INSPECTION 9

- 3.1 Observations 9
- 3.2 Evaluation 10

SECTION 4 - OPERATIONAL PROCEDURES 11

- 4.1 Normal Operational Procedure 11
- 4.2 Maintenance of Dam 11
- 4.3 Maintenance of Operating Facilities 11
- 4.4 Warning Systems 11
- 4.5 Evaluation 11

SECTION 5 - HYDROLOGIC/HYDRAULIC EVALUATION 12

- 5.1 Design Data 12
- 5.2 Experience Data 12
- 5.3 Visual Observations 12
- 5.4 Method of Analysis 12
- 5.5 Summary of Analysis 13
- 5.6 Spillway Adequacy 14

SECTION 6 - EVALUATION OF STRUCTURAL INTEGRITY 15

- 6.1 Visual Observations 15
- 6.2 Design and Construction Techniques 15
- 6.3 Past Performance 15
- 6.4 Seismic Stability 16

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES 17

- 7.1 Dam Assessment 17
- 7.2 Recommendations/Remedial Measures 17

TABLE OF CONTENTS

APPENDIX A - CHECK LIST - ENGINEERING DATA
APPENDIX B - CHECK LIST - VISUAL INSPECTION
APPENDIX C - HYDRAULICS/HYDROLOGY
APPENDIX D - PHOTOGRAPHS
APPENDIX E - GEOLOGY
APPENDIX F - FIGURES
APPENDIX G - REGIONAL VICINITY MAP AND WATERSHED BOUNDARY MAP

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
KEPHART DAM
NDI# PA-447, PENNDER# 14-89

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Kephart Dam is a combination earth and concrete structure approximately 350 feet in length with a maximum height of 20 feet. The facility has been constructed with a concrete, ogee-shaped weir section at the center flanked by earth embankment sections to either side. The concrete weir section has a 100-foot long crest and is designed to function as a service spillway. An emergency spillway is provided along the right (east) abutment and is partially comprised of the 40-foot wide bituminous surfaced park roadway. Lake drawdown is provided through a 48-inch square slide gate at the base of a concrete control tower located adjacent to the right service spillway wingwall.

b. Location. The dam is located just north of Route 504, about 7.2 miles east of Philipsburg in Rush Township, Centre County, Pennsylvania (see Figure 2, Appendix F). The dam and reservoir are contained within the Black Moshannon, Pennsylvania 7.5 minute U.S.G.S. topographic quadrangle (see Appendix G). The coordinates of the dam are N40° 55' 5" and W78° 3' 20".

c. Size Classification. Intermediate (20 feet high, greater than 1,000 acre-feet storage at maximum pool).

d. Hazard Classification. Significant (see Section 3.1.c.5).

e. Ownership. Samual R. Reed
Director of Bureau of Operations
Office of Resources Management
Pennsylvania Department of Environmental Resources
P.O. Box 1467
Harrisburg, Pennsylvania 17120

f. Purpose of Dam. Recreation.

g. Historical Data. According to data contained in PennDER files, the existing Kephart Dam was constructed in 1974 replacing a deteriorated structure previously situated about 150 feet upstream whose origin dated back to 1926. The new facility was designed by Berger Associates of Harrisburg, Pennsylvania, and was constructed by the Bear Creek Construction Company of Landisville, Pennsylvania.

1.3 Pertinent Data.

a. Drainage Area. 15.4 square miles.

b. Discharge at Dam Site.

Maximum Known Flood at Dam Site - Not known.

Outlet Works Conduit at Operating Pool Elevation (1865) - Drawdown rating curve contained in Figure 3, Appendix F.

Ungated Service Spillway Capacity at Maximum Pool Elevation (1874) ≃ 10,670 cfs.

Ungated Emergency Spillway Capacity at Maximum Pool Elevation (1874) ≃ 2,020 cfs.

Combined Ungated Spillway Capacities at Maximum Pool (1874) ≃ 12,690 cfs.

c. Elevation (feet above mean sea level).

Top of Dam ≃ 1874 (design crest of embankment).

Maximum Pool Design Surcharge ≃ 1871.

Maximum Pool of Record - Not known.

Normal Pool ≃ 1865.

Upstream Portal Invert Outlet Conduit ≃ 1853.5.

Downstream Portal Invert Outlet Conduit ≃ 1853.5.

Streambed at Centerline of Dam ≈ 1853.

Maximum Tailwater - Not known.

d. Reservoir Length (miles).

Maximum Pool ≈ 3.4.

Normal Pool ≈ 2.3.

e. Reservoir Storage (acre-feet).

Service Spillway Crest ≈ 730 (elevation 1865).

Emergency Spillway Crest ≈ 3210 (elevation 1870).

Top of Dam ≈ 5830 (elevation 1874).

Design Surcharge ≈ 2055.

f. Reservoir Surface (acres).

Service Spillway Crest ≈ 235 (elevation 1865).

Emergency Spillway Crest ≈ 535 (elevation 1870).

Top of Dam ≈ 775 (elevation 1874).

Maximum Design Pool ≈ 595 (elevation 1871).

g. Dam.

Type - Earth and concrete.

Length of Embankment ≈ 350 feet (including emergency spillway section).

Height ≈ 20 feet.

Top Width ≈ 12.5 feet.

Side Slopes - upstream: 2H:1V
downstream: 2H:1V

Zoning (earth section) - None; homogeneous earth, rolled embankment with upstream rock riprap.

Impervious Core - None; homogeneous earth section.

Cutoff - A cutoff trench 3 feet deep and 8 feet wide (at the base) with 1H:1V side slopes was provided between Stations 1+36 and 2+05 and from Station 3+33 to 3+94 (see Figure 4, Appendix F).

Grout Curtain - None.

h. Outlet Conduits.

Type - 48-inch square sluice gate housed in the concrete control structure located at the right side of the concrete ogee spillway.

Access - Top of dam (see Figure 3).

Outlet Chamber - Reinforced concrete riser with a trash rack at the base of the upstream end and a sluice gate on the downstream end. The chamber also contains stop logs and a ladder (see Figure 7).

Regulating Facility - Crank operated floor stand hoist for the sluice gate.

i. Service Spillway.

Type - Ogee-crested, reinforced concrete weir (see Photograph 1 and Figure 6).

Crest Width ≈ 100 feet.

Crest Elevation ≈ 1865.

Stilling Basin ≈ 34 feet by 107 feet.

Upstream Channel - Not applicable.

Downstream Channel - Riprap-lined trapezoidal channel.

j. Emergency Spillway.

Type - Earth; partially comprised of a bituminous paved park roadway (see Figure 3).

Crest Width ≈ 40 feet (design); 60 feet (measured).

Crest Elevation ≈ 1870.

Stilling Basin - Not applicable.

Upstream Channel - Not applicable.

Downstream Channel - Earth with some trees (see Photograph 5).

k. Regulating Outlets. 48-inch square sluice gate operated from atop the concrete riser chamber.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources.

1. Hydrology and Hydraulics. Hydrologic and hydraulic design calculations are available from PennDER files. A reservoir drawdown curve is contained on the contract drawings (see Figure 3). A spillway rating curve and the reservoir drawdown curve are also contained in the Operation and Maintenance Manual for Kephart Dam.

2. Embankment. No calculations are available concerning the design of the earth embankment section. Subsurface details are provided on "as-built" drawings available in PennDER files (see Figure 5).

3. Appurtenant Structures. Detailed design data are available from PennDER files concerning the outlet works and concrete gravity spillway section. Calculations and reinforcing details for the spillway, spillway wingwalls, and stilling basin slab are also available.

b. Design Features.

1. Embankment. Contract drawings indicate that the dam is a concrete gravity spillway structure flanked by rolled earth embankments on each end. The side slopes are 2H:1V on each face with a crest width of 12.5 feet. The embankments contain a key trench 3 feet deep and 8 feet wide at their bases with 1H:1V side slopes (see Figure 4). Riprap (12 inches thick) is provided on the upstream face to elevation 1871.

2. Appurtenant Structures.

a) Spillways. The service spillway is a 100-foot wide concrete gravity structure with an ogee-shaped crest. A concrete apron is provided for a distance of approximately 30 feet below the crest. A riprap-lined channel extends 50 feet beyond the apron before emptying into the natural stream channel.

The emergency spillway is located on the right abutment of the dam. For design purposes, the 40-foot wide roadway was considered as a broad-crested weir with a crest elevation of 1869.5. The actual width of the emergency spillway channel more closely approximates 60 feet, while the crest elevation was measured at 1870 feet. Riprap protects the right side of the dam from erosion by emergency spillway discharges as shown on Figures 3 and 4.

b) Outlet Works. The facility is provided with a 48-inch square sluice gate opening on the right side of the service spillway. Discharge through the outlet is controlled via a system of stop logs and a manually operated gate located atop the concrete chamber.

c. Design Data and Procedures.

1. Hydrology and Hydraulics. Procedures used by the design engineers included the development of a "C" curve hydrograph for the Kephart Dam watershed. The inflow hydrograph was developed based on 15.3 square miles of drainage area and peak runoff of 681 cfs per square mile. Using the 100-foot wide service spillway and a 40-foot wide emergency spillway, an outflow hydrograph with a peak of 5800 cfs was developed. When storage was considered, this resulted in a maximum pool level of 1870.9 feet. Three feet of freeboard was provided above the design pool and the top of the dam was established at 1874.0 feet.

2. Embankment. No information relative to design data and/or procedures were available.

3. Appurtenant Structures. Detailed calculations are available from PennDER files for the design of the concrete spillway section (including sliding and overturning), the spillway wingwalls, control tower walls, and the gate hoisting mechanism.

Sliding analysis of the spillway section dictated the installation of a cut-off wall extending 10 feet below the spillway base slab. Seepage analysis indicated that flow gradients were in an acceptable range.

2.2 Construction Records.

The only construction records available from PennDER files are periodic progress reports. "As-built" drawings were also prepared. Bi-weekly construction progress reports are available at the park office.

2.3 Operational Records.

No operational records are available, although the Operation and Maintenance Manual for the facility indicates that readings should be recorded, particularly during major storms.

2.4 Other Investigations.

PennDER files contain annual inspection reports through 1977.

2.5 Evaluation.

Sufficient data are available to indicate that the facility was formally designed in accordance with accepted engineering practice. Operational records should be maintained as directed in the Operation and Maintenance Manual for the facility.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The visual inspection of the structure and related appurtenances indicates that the facility is in good condition.

b. Embankment. The embankment conforms with the lines and grades depicted on the as-built drawings supplied by PennDER. No signs of slope distress or seepage were observed in the earth section at the time of inspection.

Upstream slope protection is provided by a durable limestone to elevation 1871. Riprap is also provided on the extreme right section of the dam where the embankment forms the left side of the emergency spillway.

Both the upstream and downstream faces of the dam are covered with crown vetch. Minor settlement was noted on the dam crest along both sides of the spillway. The maximum settlement noted at the time of inspection was approximately 0.6 feet below the designed crest elevation of 1874.0 feet.

c. Appurtenant Structures.

1. Service Spillway. The visual inspection of the service spillway indicated that the structure was in excellent condition. No evidence of concrete deterioration was observed at the time of inspection.

2. Emergency Spillway. The visual inspection of the emergency spillway revealed that it was unobstructed and in good condition. The calculations indicate that the emergency spillway design was prepared based on a crest width of 40 feet. Field measurements indicate that the actual width is approximately 60 feet.

3. Outlet Works. The only portions of the outlet works visible at the time of inspection were the manual gate control, the sluice gate, and the gate chamber. Although the sluice gate was not operated in our presence, it is reportedly opened twice yearly and no conditions were observed which would indicate that the gate could not function properly.

4. Reservoir Area. The slopes surrounding the reservoir are gentle to moderate and wooded. No evidence of slope distress was observed at the time of inspection.

5. Downstream Channel. Flow from Black Moshannon Reservoir passing over the Kephart Dam spillway enters Black Moshannon Creek. The stream gradient below the dam averages about 50 feet per mile and flow passes beneath Interstate 80 approximately 6 miles downstream of the dam. The downstream valley in this reach is characterized as a narrow V-shaped valley with densely wooded slopes. At least 3 temporary dwellings are located within the valley in this reach. Considering the proximity of the camps to the creek and the Interstate highway located downstream (see Appendix G - Regional Vicinity Map), the site was assigned a "significant" hazard rating.

3.2 Evaluation.

Observations made during the visual inspection indicate that the overall condition of the facility is good. Minor settlement of the embankment crest was noted. The crest should be surveyed and low spots filled in.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operational Procedures.

An Operation and Maintenance Manual for Kephart Dam details normal and emergency operational procedures. The manual is available at the park office and from PennDER files.

4.2 Maintenance of Dam.

The dam is inspected twice yearly by the park superintendent. It is also inspected on a yearly basis by an engineer of the PennDER. Formal records are kept in Harrisburg detailing required maintenance and date of completion.

4.3 Maintenance of Operating Facilities.

Maintenance of the operating facilities is detailed in the Operation and Maintenance Manual. The sluice gate is operated during each of the bi-annual inspections.

4.4 Warning Systems.

No formal warning system is in effect at the facility.

4.5 Evaluation.

The dam is well maintained and in good condition. The facility is inspected at least twice yearly and maintenance records are kept at the site as well as in Harrisburg, Pennsylvania. The park superintendent has radio contact with an FAA approved weather station located at Mid-State Airport, on the southwest side of the reservoir. A warning system should be implemented during periods of heavy rainfall to notify temporary downstream residents should the need arise.

SECTION 5
HYDRAULIC/HYDROLOGIC EVALUATION

5.1 Design Data.

Review of calculations contained in PennDER files indicates that the designer sized the spillway system by routing through the reservoir a 6-hour storm that would yield the peak inflow consistant with the Pennsylvania "C" Curve. This was done by developing a 1-hour unit hydrograph via McSparran's Method for the watershed and subsequently an inflow hydrograph for a 6-hour storm. The peak inflow for the above design storm was 8251 cfs as compared to 10,438 cfs peak inflow determined from the Pennsylvania "C" Curve criteria. Therefore, the values of the design storm hydrograph were increased by the ratio 10,438/8251 or 1.265 to develop the design "C" Curve inflow hydrograph. This hydrograph was then routed through the reservoir to set the spillway dimensions and top of dam elevation.

5.2 Experience Data.

No records of discharge are available for the facility. The park superintendent indicated that only small fluctuations in overflow have been observed. The emergency spillway has not functioned since construction.

5.3 Visual Observations.

On the date of inspection, no conditions were observed that would indicate that the facility would not operate satisfactorily during a flood event. Minor crest settlement (on the order of 0.6 feet) was noted. A survey should be conducted and the low spots in the crest raised to the design elevation.

5.4 Method of Analysis.

The facility has been analyzed in accordance with the procedures and guidelines established by the U. S. Army Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U. S. Army Corps of Engineers, Hydrologic Engineering Center, Davis, California. Analytical capabilities of the program are briefly outlined in the preface contained in Appendix C.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with the procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I investigations, the SDF for Kephart Dam ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. This classification is based on the relative size of the dam (intermediate), and the potential hazard of dam failure on downstream developments (significant). Since a major highway (Interstate Route 80) is located about 6.5 miles downstream from the dam, and a few non-permanent dwellings are located near the stream between the dam and the major highway, the SDF for this facility is considered to be the PMF.

b. Results of Analysis. Kephart Dam was evaluated under normal operating conditions. That is, the Kephart Dam Reservoir was initially at its normal pool or service spillway elevation of 1865.0 feet with the lake-drawdown slide gate closed. Design information concerning the reservoir's storage-elevation relationship and the service spillway's discharge-elevation relationship were available and used in the analysis. Although a major local highway (PA Route 504) crosses the reservoir at a point located about 1,300 feet upstream from the dam embankment (see Figure 2) and could help to further delay and thereby further attenuate a sudden large inflowing floodwave (since the highway embankment could act as an upstream dam with high tailwater), it was ignored in this evaluation. It was felt that the surface area of the reservoir was so large that the inflowing PMF would probably gradually raise the reservoir water level such that any beneficial effects of the highway embankment on the PMF inflows would be minimal. All pertinent engineering calculations relative to the analysis of Kephart Dam are provided in Appendix C.

Overtopping analysis (using the Modified HEC-1 Computer Program) showed that the discharge/storage capacity of Kephart Dam could safely accommodate the PMF. That is, the peak PMF inflow of about 17,100 cfs (Appendix C, Summary Input/Output Sheets, Sheet B) should be discharged and/or stored by Kephart Dam without overtopping the earth embankment sections. The peak PMF outflow of about 12,400 cfs raised the reservoir water level to approximately elevation 1873.9 feet (Summary Input/Output Sheets, Sheet C), or to within 0.1 foot of overtopping the dam at the design crest elevation. As noted in Section 5.3, embankment crest settlement on the order of 0.6 feet was measured during the field inspection indicating that the embankment would be locally overtopped. Thus, an accurate survey is recommended with ensuing remedial work as required.

5.6 Spillway Adequacy.

Since the spillways of Kephart Dam (in combination with the potential reservoir storage) can safely pass a flood of PMF magnitude, the spillway system is deemed adequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations, the embankment appeared in good condition. No signs of slope distress or seepage were observed. Minor settlement was noted on the crest of the dam. The largest measured settlement was approximately 0.6 feet below the design crest elevation of 1874.0. A survey is recommended and the crest should be brought to the design elevation.

b. Appurtenant Structures. Both the service and emergency spillways were in good condition. No signs of serious concrete deterioration were observed on the ogee spillway, sidewalls, or apron. The emergency spillway was unobstructed and generally conformed to details shown on the contract drawings. The hydrologic and hydraulic analysis indicates that a storm of PMF magnitude will cause the emergency spillway to flow at near capacity with the water level elevation exceeding the top elevation of the riprap that protects the right embankment. As a result it is apparent the riprap layer in this area should be extended to the top of the dam.

The 48-inch square sluice gate was not operated during the inspection; however, it is understood that the gate is opened at least twice a year. No conditions were observed which indicated that the gate could not function properly.

6.2 Design and Construction Techniques.

a. Earth Section. No data is available concerning the design and/or construction techniques used on the earth portion of the embankment.

b. Spillway Sections. Design data are available from PennDER files concerning the spillways and outlet works design. Structural analysis included a check of sliding, overturning, and piping potential. In addition, these design data indicate that the structure was designed to pass and/or store the runoff associated with a storm based on the Pennsylvania "C" curve criteria with three feet of additional freeboard provided.

6.3 Past Performance.

The facility has reportedly functioned as designed during its brief history.

6.4 Seismic Stability.

The dam is located within Seismic Zone No. 1 and it is thought that it is sufficiently stable to withstand minor earthquake induced dynamic forces. However, no calculations or investigations were performed to confirm this belief.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The visual inspection, operational history, and available engineering data suggest that the facility is in good condition.

The project is capable of passing the flow resulting from a storm of PMF magnitude without overtopping the dam; therefore, the spillway is considered adequate.

The only items of concern noted during the inspection were some low areas of the embankment crest and an apparent lack of adequate riprap protection at the emergency spillway-embankment junction.

b. Adequacy of Information. The available information is considered adequate to make an accurate Phase I assessment of the facility.

c. Urgency. The recommendations listed below should be implemented as soon as practical.

d. Necessity for Additional Investigations. No additional investigations are considered necessary at this time.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner:

a. Have the embankment crest accurately surveyed and infill any low spots to restore the embankment crest to its design elevation (1874.0 msl).

b. Extend the riprap protection to the top of the dam along the emergency spillway-embankment junction to provide slope protection in the event the emergency spillway should discharge at or near full capacity.

c. Develop a warning system to provide for the notification of temporary downstream residents should hazardous conditions develop.

APPENDIX A

CHECK LIST - ENGINEERING DATA

NAME OF DAM: Kephart Lake Dam

NDI#: PA-447 PENNDER# : 14-89

CHECK LIST
ENGINEERING DATA
PHASE I

ITEM	REMARKS NDI# PA - 447
PERSONS INTERVIEWED AND TITLE	Charles Rea - Park Superintendent
REGIONAL VICINITY MAP	U.S.G.S. 7.5 minute topographic quadrangle, Black Moshannon, Pennsylvania (Regional Vicinity Map, Appendix G) and Vicinity Plan (Figure 2, Appendix C).
CONSTRUCTION HISTORY	1. Designed by Berger Associates, Inc., Harrisburg, PA, in 1973. 2. Constructed by Bear Creek Construction Company, Landisville, PA, 1974-1975. 3. Bi-weekly construction reports prepared by Berger Associates are contained in the park office files.
AVAILABLE DRAWINGS	Complete set of "As-built" drawings are available from PennDER.
TYPICAL DAM SECTIONS	See Figure 4, Appendix C.
OUTLETS:	
PLAN	See Figure 7, Appendix C.
DETAILS	See Figure 7, Appendix C.
DISCHARGE RATINGS	Available in PennDER files and displayed on Figure 2, Appendix C.

ENGINEERING DATA (CONTINUED)

ITEM	REMARKS NDI# PA - 447
SPILLWAY:	
PLAN	See Figure 6, Appendix C.
SECTION	See Figure 6, Appendix C.
DETAILS	See Figure 6, Appendix C.
OPERATING EQUIPMENT PLANS AND DETAILS	See Figure 7, Appendix C. A description of the workings of the operating mechanisms is contained in the Operation and Maintenance Manual for Kephart Dam, Black Moshannon State Park, available at the park office and from PennDER.
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS:	
HYDROLOGY AND HYDRAULICS	Some design data available in PennDER files.
STABILITY ANALYSES	Some design data available in PennDER files.
SEEPAGE ANALYSES	Some design data available in PennDER files.
MATERIAL INVESTIGATIONS:	
BORING RECORDS	See Figure 5, Appendix C.
LABORATORY TESTING	None available.
FIELD TESTING	None available.

ENGINEERING DATA (CONTINUED)

ITEM	REMARKS NDI# PA - 447
BORROW SOURCES	Not known.
POST CONSTRUCTION DAM SURVEYS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	1. One year guarantee inspection on August 3, 1976 - minor seepage through form tie above sluice gate - otherwise excellent condition. 2. Park superintendent inspects twice yearly. 3. PennDER inspects yearly.
HIGH POOL RECORDS	Not known.
MONITORING SYSTEMS	1. Staff gage on spillway sidewall - not read on regular or scheduled basis. 2. Rainfall gage at sewage plant below dam (1972). 3. FAA approved weather station at Mid-State Airport located atop the highlands southwest of the reservoir.
MODIFICATIONS	1. Slopes seeded with crown vetch.

ENGINEERING DATA (CONTINUED)

NDI# - PA - 447

ITEM	REMARKS
PRIOR ACCIDENTS OR FAILURES	None.
MAINTENANCE: RECORDS MANUAL	R - Formal (written) records of maintenance requirements and completion of required items. M - Operations and Maintenance Manual for Kephart Dam by PennDER (office of Engineering and Construction).
OPERATION: RECORDS MANUAL	R - Operational records are not available. M - Operations and Maintenance Manual kept at Park Office.
OPERATIONAL PROCEDURES	Operational procedures detailed in manual.
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	FAA weather station at airport. No other warning systems.
MISCELLANEOUS	Sluice gate operated twice yearly. Painted all metal works in May 1978.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-447
PENN DER ID # 14-89
PAGE 5 OF 5

SIZE OF DRAINAGE AREA: 15.3 square miles.

ELEVATION TOP NORMAL POOL: 1865 STORAGE CAPACITY: 730

ELEVATION TOP FLOOD CONTROL POOL: 1870 STORAGE CAPACITY: 3210

ELEVATION MAXIMUM DESIGN POOL: 1871 STORAGE CAPACITY: 3775

ELEVATION TOP DAM: 1874.0 STORAGE CAPACITY: 5830

SPILLWAY DATA

CREST ELEVATION: Service (1865); Emergency (1870)

TYPE: Service (concrete ogee); Emergency (earth)

WIDTH: Service (100 feet); Emergency (≈60 feet)

LENGTH: Service (30 feet); Emergency

SPILLOVER LOCATION: Service (near dam center); Emergency (right abutment)

NUMBER AND TYPE OF GATES: None

OUTLET WORKS

TYPE: 48-inch square sluice gate

LOCATION: right side of service spillway

ENTRANCE INVERTS: 1853.5

EXIT INVERTS: 1853.5

EMERGENCY DRAWDOWN FACILITIES: Manually controlled gate

HYDROMETEOROLOGICAL GAGES

TYPE: FAA approved weather station

LOCATION: Southwest side of reservoir (Mid-State Airport)

RECORDS: Available from weather bureau

MAXIMUM NON-DAMAGING DISCHARGE: Not known

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

PAGE 1 OF 8

NAME OF DAM Kephart Dam
STATE Pennsylvania
COUNTY Centre

NDI# PA - 447
PENNDER# 14-89

TYPE OF DAM Earth and concrete
SIZE Intermediate
HAZARD CATAGORY Significant

DATE(S) INSPECTION 13, 14 November 1978
WEATHER cold with rain
TEMPERATURE 35° @ 11:00 AM

POOL ELEVATION AT TIME OF INSPECTION 1865 M.S.L.

TAILWATER AT TIME OF INSPECTION 1855 M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	OTHERS
B. M. Mihalcin	Charles Rae (Park Superintendent)	
J. P. Nairn		
W. J. Veon		
E. J. Mannella		

RECORDED BY B. M. Mihalcin

EMBANKMENT

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 447
SURFACE CRACKS	None observed.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment - good. Slight vertical misalignment - 0.6 feet low in two areas.
RIPRAP FAILURES	None observed.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good.

EMBANKMENT

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 447
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	None observed.
ANY NOTICEABLE SEEPAGE	None observed.
STAFF GAGE AND RECORDER	Staff gage on left sidewall of spillway.
DRAINS	None observed.

OUTLET WORKS

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 447
INTAKE STRUCTURE	Submerged.
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	Not applicable.
OUTLET STRUCTURE	Control tower in excellent condition.
OUTLET CHANNEL	Outlet discharges in stilling basin before water passes into riprap-lined channel.
GATE(S) AND OPERATIONAL EQUIPMENT	Gate appeared in good order. Hoisting mechanism in excellent condition. Not operated during field inspection.

EMERGENCY SPILLWAY

NDI# PA - 447

ITEM	OBSERVATIONS AND/OR REMARKS
TYPE AND CONDITION	Open channel overflow around right abutment and over park road. Good condition.
APPROACH CHANNEL	Natural embankment - unobstructed.
SPILLWAY CHANNEL AND SIDEWALLS	Natural channel with bituminous roadway. Embankment riprap lined. Good condition.
STILLING BASIN PLUNGE POOL	Not applicable.
DISCHARGE CHANNEL	Over natural ground at the right abutment and then into Black Moshannon Creek (See Figure 4, Appendix C).
BRIDGE AND PIERS	Bridge over Black Moshannon Creek 140 feet downstream.
EMERGENCY GATES	None.

SERVICE SPILLWAY

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 447
TYPE AND CONDITION	100-foot wide concrete ogee-shaped crest in excellent condition (See Figure 6, Appendix C).
APPROACH CHANNEL	Not applicable.
OUTLET STRUCTURE	Not applicable.
DISCHARGE CHANNEL	Discharge empties into a stilling basin before entering a riprap-lined channel and Black Moshannon Creek (See Figure 3, Appendix C).

INSTRUMENTATION

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 447
MONUMENTATION SURVEYS	None observed. Plan indicates two monuments installed.
OBSERVATION WELLS	None.
WEIRS	None.
PIEZOMETERS	None.
OTHERS	None.

RESERVOIR AREA AND DOWNSTREAM CHANNEL

NDI# PA - 447

ITEM	OBSERVATIONS AND/OR REMARKS
SLOPES: RESERVOIR	Gentle to moderate and wooded.
SEDIMENTATION	Sedimentation is not likely a problem since the reservoir slopes are gentle and covered with vegetation.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Bridge located 140 feet downstream of stilling basin. Culvert Beneath Interstate 80, 6 miles downstream.
SLOPES: CHANNEL VALLEY	Steep and heavily wooded downstream of dam.
APPROXIMATE NUMBER OF HOMES AND POPULATION	At least three cabins or temporary residences are located between the dam and Interstate 80 - temporary population ≈9.

APPENDIX C

HYDRAULICS/HYDROLOGY

PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: 1) the evaluation of the overtopping potential of the dam; and 2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.

c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as shown below.

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir.

c. Development of a failure hydrograph(s) based on specified breach criteria and normal reservoir outflow.

d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak and maximum water surface elevations of failure hydrographs for each location.

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 2-19-79 PROJ. NO. 78-617-447
CHKD. BY WJV DATE 3-3-79 SHEET NO. 1 OF 14

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DAM STATISTICS

HEIGHT OF DAM ≃ 20 FEET (FIELD MEASURED)

MAXIMUM POOL STORAGE CAPACITY ≃ 5830 AC-FT (SEE NOTE 1)
@ TOP OF DAM

NORMAL POOL STORAGE CAPACITY ≃ 730 AC-FT (SEE NOTE 1)

DRAINAGE AREA ≃ 15.4 SQ. MI

PLANIMETERED OFF U.S.G.S. 7.5 MINUTE SERIES TOPOGRAPHIC QUADRANGLES BLACK MCSHANNON, PORT MATILDA, AND BEAR KNOB

NOTE 1: VALUES OBTAINED FROM KEPHART DAM DESIGN CALCULATIONS AS PREPARED BY BERGER ASSOCIATES OF HARRISBURG, PENNSYLVANIA AND CONTAINED IN PENNDER FILES (SEE SHEETS 4, 5 & 6)

DAM CLASSIFICATION

DAM SIZE - INTERMEDIATE (REF 1, TABLE 1)

HAZARD CLASSIFICATION - SIGNIFICANT (FIELD OBSERVATI

REQUIRED SDF - ½ PMF TO PMF (REF 1, TABLE

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 3-1-79 PROJ. NO. 78-617-447
CHKD. BY WJV DATE 3-3-79 SHEET NO. 2 OF 14

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HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE ≃ 5.8 MILES

L_{CA} ≃ 2.0 MILES [MEASURED ALONG THE LONGEST WATERCOURSE FROM THE CREST OF THE DAM TO THE CENTROID OF THE DRAINAGE BASIN]

LENGTH OF RESERVOIR ≃ 2.1 MILES (ALONG THE LONGEST WATERCOURSE)

NOTE 2: VALUES OF L, L_{CA}, AND RESERVOIR LENGTH MEASURED FROM U.S.G.S. 7.5 MINUTE SERIES QUADS PORT MATILDA, BEAR KNOB, AND BLACK MOSHANNON, PA.

$$\left.\begin{aligned} C_t &= 2.10 \\ C_p &= 0.40 \end{aligned}\right\}$$

[SUPPLIED BY C OF E; ZONE 20, SUSQUEHANNA RIVER BASIN]

SINCE RESERVOIR LENGTH > L_{CA}

* t_p = SNYDER'S STANDARD LAG = $2.10\,(L')^{0.6}$

where L' = LENGTH ALONG LONGEST WATERCOURSE FROM THE RESERVOIR INLET TO THE DRAINAGE DIVIDE

$$t_p = (2.10)\left[(5.8-2.1)\right]^{0.6} = 4.60 \text{ HR}$$

* AS PER BALTIMORE DISTRICT CORPS OF ENGINEERS FOR CASES WHERE THE LENGTH OF RESERVOIR IS ≥ L_{CA}

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 3-1-79 PROJ. NO. 78-617-447
CHKD. BY WJV DATE 3-2-79 SHEET NO. 3 OF 14

RESERVOIR SURFACE AREAS

S.A. (SURFACE AREA) @ NORMAL POOL EL 1865.0 ≃ 235 ACRES (SEE NOTE 3)

S.A. @ EL 1880.0 ≃ 1140 ACRES

(REF. FIGURE 4, APPENDIX F FOR ELEVATIONS)

[PLANIMETERED OFF U.S.G.S. 7.5 MINUTE SERIES QUADS PORT MATILDA, BEAR KNOB, AND BLACK MOSHANNON, PA.]

RATE OF AREA CHANGE PER FOOT OF RISE $\left[\frac{\Delta A}{\Delta h}\right] \simeq \frac{1140-235}{1880-1865} \simeq 60$ AC/FT

S.A. @ TOP OF DAM EL 1874.0 ≃ (60 AC/FT)(1874 - 1865) + 235 ACRES

≃ 775 ACRES

NOTE 3: NORMAL POOL SURFACE AREA OBTAINED FROM "OPERATION AND MAINTENANCE MANUAL FOR KEPHART DAM, BLACK MOSHANNON STATE PARK" PREPARED BY PENNDER AND AVAILABLE FROM THEIR FILES

STORAGE - ELEVATION RELATIONSHIP

A STORAGE-ELEVATION RELATIONSHIP AS DEVELOPED BY BERGER ASSOCIATES OF HARRISBURG, PA. IS AVAILABLE FROM PENNDER FILES AND IS REPRODUCED FOR THIS REPORT ON SHEETS 4 & 5. SHEET 4 REPRESENTS THE CALCULATED RELATIONSHIP FOR ELEVATION 1854 (ZERO STORAGE) TO ELEVATION 1865 (NORMAL POOL) WHEREAS, SHEET 5 GRAPHICALLY ILLUSTRATES THE RELATIONSHIP BETWEEN ELEVATION 1865 AND ELEVATION 1870 (EMERGENCY SPILLWAY CREST).

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM

BY DLB DATE 3-6-79 PROJ. NO. 78-617-447

CHKD. BY WJV DATE 3-6-79 SHEET NO. 4 OF 14

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BY T.M. DATE
CHKD. BY DATE
SUBJECT Kepart Dam-Black Moshannon State Park

BERGER ASSOCIATES

SHEET NO. 8 OF 12
PROJECT

Determination of reservoir capacities between elevations 1854 & 1865. (Approximate)

1. Assume that the reservoir or lake has a parabolic cross section throughout & the area of the section decreases to zero at the end of the res.

$A = \frac{4}{3} D \frac{W}{2}$

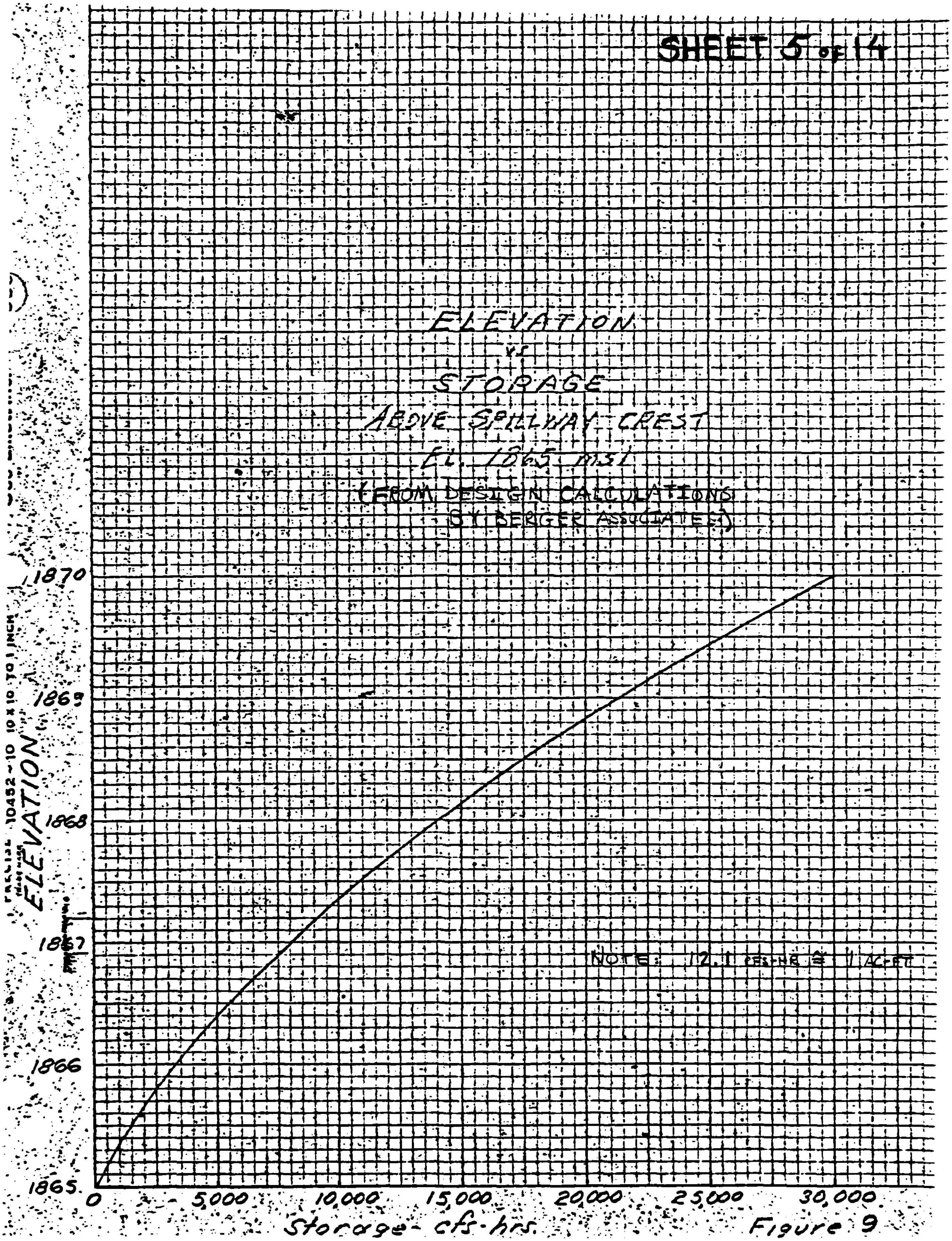
2. Assume that total reservoir length decreases proportionately with decreasing depth (D)

3. Assume that the average width (W) also decreases proportionately with height

4. $V = \frac{4}{3} D \times \frac{W}{2} \times \frac{L}{2} = \frac{1}{3} DWL$
$\rightarrow \div 43{,}560 = \text{ac. ft}$

Elev.	D(ft)	W(ft)**	L(ft)*	V acft
1854.0	0	0	0	0
1855.0	1 (0.091)	41	1,757	0.55
1856.0	2 (0.182)	82	3,514	4.41
1857.0	3 (0.273)	123	5,270	14.87
1858.0	4 (0.364)	164	7,030	35.25
1859.0	5 (0.455)	205	8,790	68.88
1860.0	6 (0.545)	245	10,520	118.22
1861.0	7 (0.636)	286	12,280	187.94
1862.0	8 (0.727)	327	14,040	280.78
1863.0	9 (0.818)	368	15,800	400.04
1864.0	10 (0.909)	409	17,550	548.73
1865.0	11	450	19,310	730.71

* Total length of lake including fingers. (See ~~attached~~ location plan)
** Est. Average width



ELEVATION
vs
STORAGE
ABOVE SPILLWAY CREST
EL. 1865 msl
(FROM DESIGN CALCULATIONS
BY BERGER ASSOCIATES)

NOTE: 12.1 cfs-hr ≙ 1 ac-ft

Figure 9

PRECISE 10452-10 10 X 10 TO 1 INCH

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 3-2-79 PROJ. NO. 78-617-447
CHKD. BY WJV DATE 3-3-79 SHEET NO. 6 OF 14

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ASSUME THE MODIFIED PRISMOIDAL EQUATION IS AN ACCEPTABLE REPRESENTATION OF THE STORAGE INCREMENTS ABOVE ELEVATION 1870.

$$\Delta V_{1-2} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{(A_1)(A_2)}\right)$$

where ΔV_{1-2} = INCREMENTAL VOLUME BETWEENS AREAS 1 & 2
A_1 = SURFACE AREA AT ELEVATION 1
A_2 = SURFACE AREA AT ELEVATION 2
h = (ELEVATION 2 - ELEVATION 1)

ALSO SURFACE AREA IS DEFINED BY

$$A_i = A_0 + h\left(\frac{\Delta A}{\Delta h}\right)$$

where A_i = S.A. @ ELEVATION i
A_0 = S.A. @ ELEVATION 1865 = 235 ACRES (SHEET 3)
h = ELEVATION i - ELEVATION 1965 FT
$\frac{\Delta A}{\Delta h}$ = 60 AC-FT (SHEET 3)

ELEVATION (FT)	h (FT)	A_i (ACRES)	ΔV (AC-FT)	CUMULATIVE VOLUME (AC-FT)
1870	1	535	565	3210*
1871	1	595	625	3775
1872	1	655	685	4400
1873	1	715	745	5085
1874	1	775	805	5830
1875	1	835	865	6635
1876	1	895	925	7500
1877		955		8425

* 2480 AC-FT @ EL1870 (SHEET 5) + 730 AC-FT @ EL1865 (SHEET 4)

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM

BY DLB DATE 2-19-79 PROJ. NO. 78-617-447

CHKD. BY WJV DATE 3-3-79 SHEET NO. 7 OF 14

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PMP CALCULATIONS

STANDARD RAINFALL INDEX = 22.2 INCHES (REF. 9, FIG. 2)
(CORRESPONDING TO A DURATION OF 24 HRS
AND AN AREA OF 200 SQ. MI.)

GEOGRAPHIC ADJUSTMENT FACTOR = 103% (REF 9, FIG. 1)
(CORRESPONDING TO A LONGITUDE OF 78° 3'
AND A LATITUDE OF 40° 55')

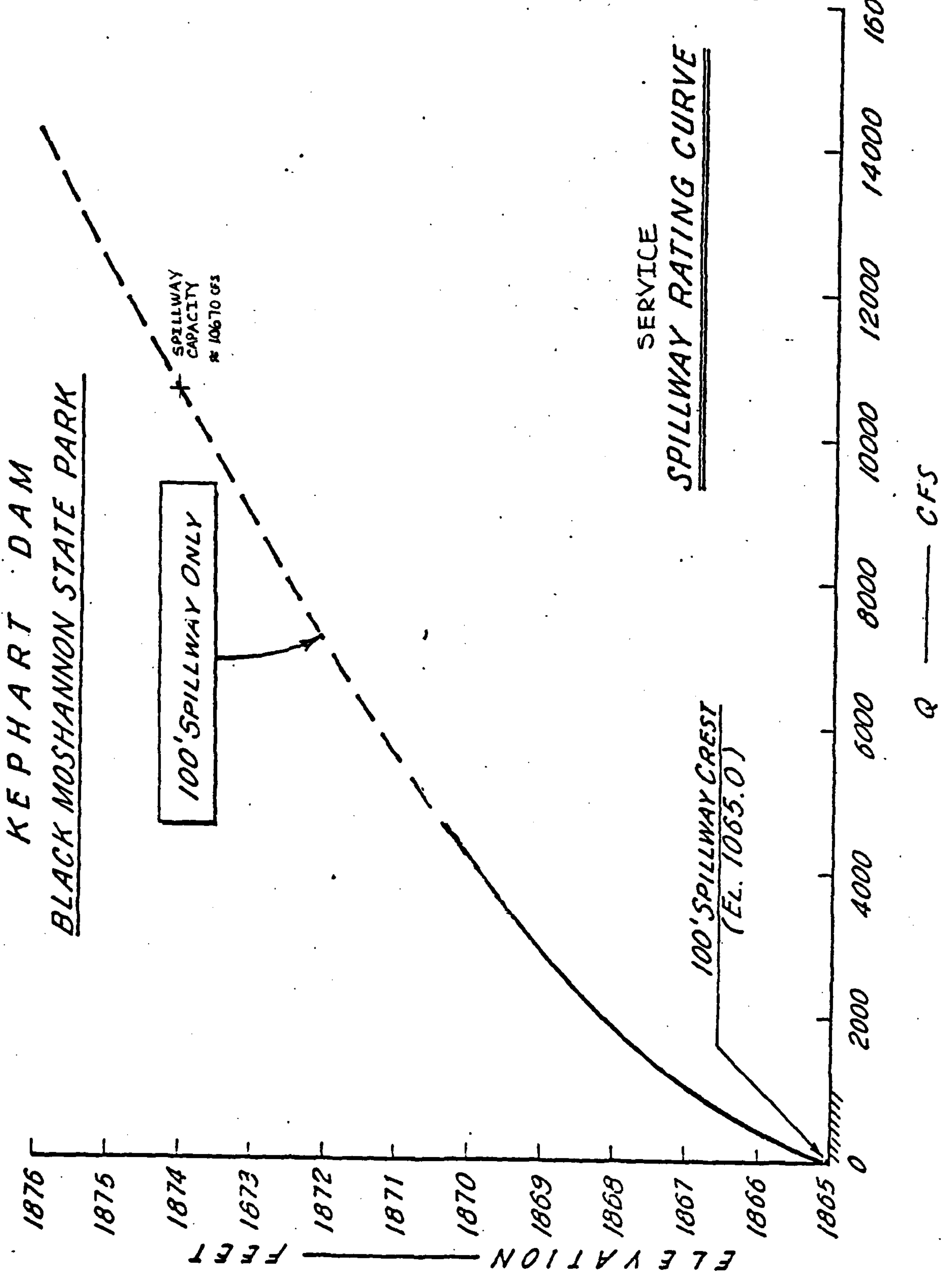
CORRECTED RAINFALL INDEX = (1.03)(22.2) = 22.9 INCHES

DURATION (HOURS)	PERCENT OF INDEX RAINFALL (%)
6	113.0
12	122.5
24	132.0
48	138.0
72	141.5

- HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE, AS WELL AS FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALLER AREA) CORRESPONDING TO A D.A. = 15.4 SQ. MI. ≈ .815 (AS COMPUTED BY HEC-1 PROGRAM)

SERVICE SPILLWAY CAPACITY AND RATING CURVE :

OBTAINED FROM THE "OPERATION AND DESIGN MANUAL FOR KEPHART DAM, BLACK MOSHANNON STATE PARK", DEPARTMENT OF ENVIRONMENTAL RESOURCES, HARRISBURG, PA. APRIL 1976



SUBJECT Dam Safety Inspection

Kephart Dam

BY DLB DATE 2-19-79 PROJ. NO. 78-617-447

CHKD. BY WJV DATE 3-3-79 SHEET NO. 9 OF 14

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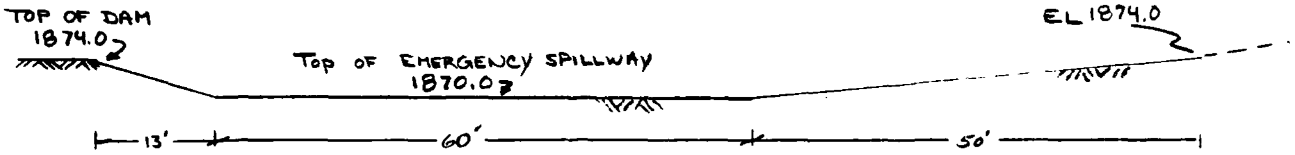
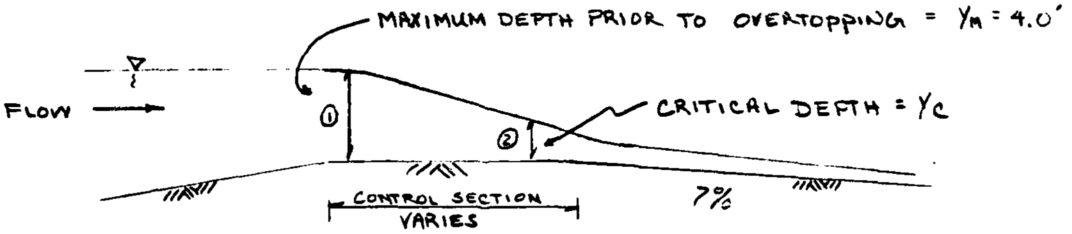
EMERGENCY SPILLWAY CAPACITY & RATING CURVE

NOTE: ALTHOUGH THE DESIGN EMERGENCY SPILLWAY RATING CURVE IS ALSO AVAILABLE, IT IS BASED ON A SECTION WITH A BOTTOM WIDTH OF 40 FT AND A CREST ELEVATION AT 1869.5 FT. FIELD MEASUREMENTS INDICATE THAT THE ACTUAL SECTION HAS A BOTTOM WIDTH OF ABOUT 60 FT AND A CREST ELEVATION AT ABOUT 1870 FT. THE FOLLOWING IS BASED ON THESE FIELD MEASUREMENTS AND THE GIVEN RATING CURVE HAS BEEN DISCARDED.


TOP OF DAM
1874.0
EL 1874.0
Top of EMERGENCY SPILLWAY
1870.0
13'
60'
50'

EMERGENCY SPILLWAY CROSS-SECTION (FIELD MEASURED)
SCALE 1 IN = 20 FT


MAXIMUM DEPTH PRIOR TO OVERTOPPING = $Y_M = 4.0'$
FLOW
①
②
CRITICAL DEPTH = Y_c
CONTROL SECTION
VARIES
7%

EMERGENCY SPILLWAY PROFILE
(NOT TO SCALE)

$$Y_M + \cancelto{0}{\frac{V_R^2}{2g}} = Y_c + \frac{V_c^2}{2g} + \cancelto{0}{H_L}$$

ENERGY BALANCE BETWEEN SECTIONS @ ① & ② (REF 7, pg 40)

where

H_L = HEAD LOSS BETWEEN ① AND ② ≈ 0

V_R = APPROACH VELOCITY OF RESERVOIR (ASSUMED NEGLIGIBLE)

V_c = CRITICAL VELOCITY

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 2-19-79 PROJ. NO. 78-617-447
CHKD. BY WJV DATE 3-3-79 SHEET NO. 10 OF 14

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$$4.0' = y_c + \frac{V_c^2}{2g}$$

AT CRITICAL DEPTH $\frac{V_c^2}{2g} = \frac{\Delta_c}{2}$ (REF 7, pg 55)

Δ_c = HYDRAULIC DEPTH = $\frac{\text{AREA OF FLOW}}{\text{TOP WIDTH}} = \frac{A_c}{W_c}$ (REF 7, pg 23)

$$A_c = 60y_c + \tfrac{1}{2}(12.5y_c)y_c + \tfrac{1}{2}(3.25y_c)y_c = 60y_c + 7.9y_c^2$$

$$W_c = 60 + 12.5y_c + 3.25y_c = 15.8y_c + 60$$

$$\therefore\ 4.0' = y_c + \frac{60y_c + 7.9y_c^2}{2(15.8y_c + 60)} = y_c + \frac{60y_c + 7.9y_c^2}{31.6y_c + 120}$$

$$126.4y_c + 480 = 31.6y_c^2 + 120y_c + 60y_c + 7.9y_c^2$$

$$0 = 39.5y_c^2 + 53.6y_c - 480 = ay_c^2 + by_c - c$$

$\therefore\ y_c = 2.87'$ [AS PER QUADRATIC EQUATION $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$]

SINCE $\frac{V_c^2}{2g} = \frac{60y_c + 7.9y_c^2}{2(15.8y_c + 60)}$

$$V_c = \left[\frac{(32.2)[(60)(2.87) + (7.9)(2.87)^2]}{[(15.8)(2.87) + (60)]}\right]^{1/2} = 8.52 \text{ FPS}$$

FROM CONTINUITY $Q = VA$ (REF 7, pg 5)

$$Q = (8.52)[(60)(2.87) + (7.9)(2.87)^2] = 2022 \text{ cfs}$$

MAXIMUM EMERGENCY SPILLWAY CAPACITY ≃ 2020 CFS

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 3-2-79 PROJ. NO. 78-617-447
CHKD. BY WJV DATE 3-3-79 SHEET NO. 11 OF 14

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CHECK TO SEE IF CRITICAL FLOW CONTROLS:

CRITICAL SLOPE $(S_c) \approx \left[\dfrac{n V_c}{1.49 R_c^{2/3}}\right]^2$ (REF 13, pg 143)

where R_c = HYDRAULIC RADIUS = $\dfrac{\text{AREA OF FLOW}}{\text{WETTED PERIMETER}}$

$$R_c \approx \frac{(60)(2.87) + (2.87)^2(7.9)}{60 + \left[(2.87)^2 + [(2.87)(3.25)]^2\right]^{1/2} + \left[(2.87)^2 + [(2.87)(12.5)]^2\right]^{1/2}} \approx 2.24 \text{ FT}$$

n = MANNING'S ROUGHNESS COEFFICIENT

$$n \text{ (AREA WEIGHTED)} \approx \frac{(51)n_1 + (172)n_2 + (13)n_3}{236}$$

**where* $n_1 \approx 0.10$ (RIGHT BANK; MEDIUM TO DENSE BRUSH AND TREES)
$n_2 \approx 0.02$ (CENTER OF CHANNEL; GRAVEL & CONCRETE ROAD SURFACE
$n \approx 0.04$ (LEFT BANK; RIPRAP & GRASS)

* BASED ON THE JUDGEMENT AND EXPERIENCE OF A/E AS WELL AS REFERENCE 7, pgs 111-113

$\therefore\ n \approx 0.038$

$$\therefore\ S_c \approx \left[\frac{(0.038)(8.52)}{1.49(2.24)^{2/3}}\right]^2 \approx 0.02$$

$S_c \approx 0.02 < 0.07$ (ACTUAL SLOPE)

∴ SUPERCRITICAL FLOW BELOW SECTION ② & CRITICAL FLOW @ SECTION ②

SUBJECT	DAM SAFETY INSPECTION KEPHART DAM		
BY DLB	DATE 2-19-79	PROJ. NO. 78-617-447	
CHKD. BY WJV	DATE 3-3-79	SHEET NO. 12	OF 14

BASED ON CALCULATIONS CONTAINED ON SHEETS 9, 10, AND 11, THE FOLLOWING RATING TABLE WAS DEVELOPED FOR THE EMERGENCY SPILLWAY

	ELEVATION (FEET)	He (FEET)	Q (CFS)
	1870.0	0	0
	1871.0	1	200
	1872.0	2	620
	1873.0	3	1230
Top of DAM	1874.0	4	2020
	1875.0	5	3030
	1876.0	6	4230

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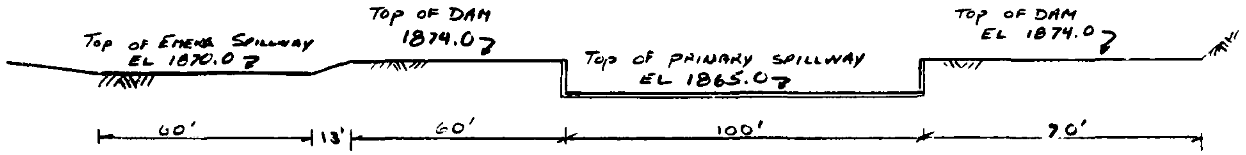
SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 2-19-79 PROJ. NO. 78-617-447
CHKD. BY WJV DATE 3-3-79 SHEET NO. 13 OF 14

EMBANKMENT RATING CURVE


Top of Emerg Spillway
EL 1870.0
Top of DAM
1874.0
Top of Primary Spillway
EL 1865.0
Top of DAM
EL 1874.0
60'
13'
60'
100'
70'

EMBANKMENT CROSS-SECTION
SCALE 1 IN = 50 FT

DISCHARGES DEFINED BY $Q = CLH_e^{3/2}$

ASSUME EMBANKMENT ACTS LIKE A BROAD CRESTED WEIR
WHEN OVERTOPPED: CREST LENGTH (w/o SPILLWAYS) $\approx$ 130 FT
CREST BREADTH = 12.5 FT = ℓ
CREST ELEVATION = 1874.0 FT

ELEVATION (FT)	H (FT)	H/ℓ (FT/FT)	* C	Q (CFS)
1874.0	0	-	-	-
1875.0	1	0.08	3.03	390
1876.0	2	0.16	3.06	1130

* VALUES OF C OBTAINED FROM REF 12, pg 46

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 2-21-79 PROJ. NO. 78-617-447
CHKD. BY WJY DATE 3-3-79 SHEET NO. 14 OF 14

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TOTAL DISCHARGE RATING CURVE

COMBINED RATING CURVES FOR SERVICE SPILLWAY, EMERGENCY SPILLWAY, AND DAM EMBANKMENT.

	ELEVATION (FT)	① SERVICE SPILLWAY Q (CFS)	② EMERGENCY SPILLWAY Q (CFS)	③ EMBANKMENT Q (CFS)	TOTAL DISCHARGE Q (CFS)
CREST OF SERVICE SPILLWAY →	1865.0	–	–	–	–
	1866.0	400	–	–	400
	1867.0	1030	–	–	1030
	1868.0	1810	–	–	1810
	1869.0	2880	–	–	2880
CREST OF EMERGENCY SPILLWAY →	1870.0	4230	–	–	4230
	1871.0	5560	200	–	5760
	1872.0	7140	620	–	7760
	1873.0	8910	1230	–	10140
TOP OF DAM →	1874.0	10670	2020	–	12690
	1875.0	12320	3030	390	15740
	1876.0	14210	4230	1130	19570

① SHEET 8
② SHEET 12
③ SHEET 13

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM
BY DLB DATE 3-6-79 PROJ. NO. 78-617-447
CHKD. BY WJV DATE 3-6-79 SHEET NO. A OF C

CONSULTANTS, INC
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Environmental Specialists

```
DAM SAFETY INSPECTION
KEPHART DAM ********* OVERTOPPING ANALYSIS *********
15-MINUTE TIME STEP AND 72-HOUR STORM DURATION

                              JOB SPECIFICATION
   NQ       NHR      NMIN     IDAY      IHR      IMIN     METRC     IPLT     IPRT    NSTAN
  288         0        15        0        0         0         0        0        0        0
                              JOPER      NWT     LROPT     TRACE
                                  5        0         0         0

                         MULTI-PLAN ANALYSES TO BE PERFORMED
                              NPLAN= 1 NRTIO= 4 LRTIO= 1
     RTIOS=     .50     .80     .90    1.00


*********          *********          *********          *********          *********

                              SUB-AREA RUNOFF COMPUTATION

 INFLOW INTO RESERVOIR

                  ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                      1        0        0        0        0        0        1        0        0

                                   HYDROGRAPH DATA
          IHYDG     IUHG    TAREA     SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
              1        1    15.40     0.00    15.40     0.00    0.000        0        1        0

                                     PRECIP DATA
                    SPFE      PMS       R6      R12      R24      R48      R72      R96
                    0.00    22.90   113.00   122.50   132.00   138.00   141.50     0.00
TRSPC COMPUTED BY THE PROGRAM IS   .815
```

INITIAL AND CONSTANT RAINFALL LOSS RATES, OBTAINED FROM BALTIMORE DISTRICT COE

```
                                     LOSS DATA
        LROPT    STRKR    DLTKR    RTIOL    ERAIN    STRKS    RTIOK    STRTL    CNSTL    ALSMX    RTIMP
            0     0.00     0.00     1.00     0.00     0.00     1.00     1.00      .05     0.00     0.00

                                UNIT HYDROGRAPH DATA
                           TP=  4.00     CP= .40     NTA=  0
```

BASE FLOW GENERATION PARAMETERS, OBTAINED FROM BALTIMORE DISTRICT COE.

```
                                   RECESSION DATA
                      STRTQ=    -1.50     QRCSN=     -.05     RTIOR= 2.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=18.83 AND R=34.28 INTERVALS

          UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG=   4.64 HOURS, CP=  .40  VOL=  .93
     10.        38.        76.       127.       182.       243.       309.       378.       451.       526.
    599.       665.       723.       774.       817.       851.       876.       891.       889.       871.
    840.       822.       798.       775.       753.       731.       710.       690.       670.       651.
    632.       613.       596.       579.       563.       546.       531.       515.       501.       486.
[illegible] [illegible]   445.       433.       420.       406.       396.       385.       374.       363.
    353.       343.       333.       323.       314.       305.       296.       288.       279.       271.
    263.       256.       249.       241.       234.       228.       221.       215.       209.       203.
    197.       191.       186.       180.       175.       170.       165.       160.       156.       151.
    147.       143.       139.       135.       131.       127.       123.       120.       116.       113.
    110.       107.       104.       101.        98.        95.        92.        90.        87.        84.
```

SUBJECT DAM SAFETY INSPECTION
KEPHART DAM

BY DLB DATE 3-6-79 PROJ. NO. 78-617-447

CHKD. BY WJV DATE 3-6-79 SHEET NO. B OF C

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Environmental Specialists

```
                                              END-OF-PERIOD FLOW
    O
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q       MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS   COMP Q

                                                                           SUM   26.40  23.72  2.68   872744
                                                                                 (671.) (603.) (68.)(24713.36)


                          PEAK     6-HOUR    24-HOUR    72-HOUR     TOTAL VOLUME
RESERVOIR  (      CFS    17086.    15240.      8492.      3030.          872648.
INFLOW     {      CMS      484.      431.       240.        86.           24711.      PMF
HYDROGRAPH {   INCHES                9.20      20.52      21.96            21.96
           (       MM              233.66     521.15     557.87           557.87
           (    AC-FT               7552.     16843.     18030.           18030.
           (THOUS CU M              9315.     20776.     22240.           22240.


                                          HYDROGRAPH ROUTING

                ROUTE THROUGH RESERVOIR

                          ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                            101       1       0       0       0       0       1       0       0
                                               ROUTING DATA
                  QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
                    0.0   0.000    0.00       1       1       0       0               0

                          NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                              1       0       0   0.000   0.000   0.000    731.      -1

STAGE      1865.00     1866.00     1867.00     1868.00     1869.00     1870.00     1871.00     1872.00     1873.00
           1875.00     1876.00

FLOW          0.00      400.00     1030.00     1810.00     2880.00     4230.00     5760.00     7760.00    10140.00
          15740.00    19570.00

CAPACITY=        731.       1003.      1392.      1888.      2491.      3210.      3775.      4400.      5005.      5830.
                6635.       7500.

ELEVATION=      1865.       1866.      1867.      1868.      1869.      1870.      1871.      1872.      1873.      1874.
                1875.       1876.

                        CREL   SPWID    COQW    EXPW   ELEVL    COQL   CAREA    EXPL
                      1865.0     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                                DAM DATA
                                        TOPEL    COQD    EXPD  DAMWID
                                       1874.0     0.0     0.0      0.
```

SUBJECT	DAM SAFETY INSPECTION KEPHART DAM				
BY	DLB	DATE	3-6-79	PROJ. NO.	79-617-447
CHKD. BY	WJV	DATE	3-6-79	SHEET NO.	C OF C

CONSULTANTS, INC
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Environmental Specialists

RESERVOIR OUTFLOW HYDROGRAPH (PMF)

```
PEAK OUTFLOW IS    12431. AT TIME  48.00 HOURS

                 PEAK    6-HOUR    24-HOUR    72-HOUR   TOTAL VOLUME
       CFS     12431.    11902.     7784.      2879.        829241.
       CMS       352.      337.      220.        82.         23481.
    INCHES                 7.19     18.81      20.87          20.87
        MM               182.62    477.70     530.12         530.12
     AC-FT                5902.    15439.     17133.          17133.
 THOUS CU M               7280.    19044.     21133.          21133.
```

```
                        SUMMARY OF DAM SAFETY ANALYSIS

                     INITIAL VALUE      SPILLWAY CREST     TOP OF DAM
        ELEVATION       1865.00            1865.00          1874.00
        STORAGE           731.               731.            5830.
        OUTFLOW             0.                 0.           12690.

 RATIO    MAXIMUM     MAXIMUM    MAXIMUM    MAXIMUM    DURATION     TIME OF      TIME OF
  OF     RESERVOIR     DEPTH     STORAGE    OUTFLOW    OVER TOP   MAX OUTFLOW    FAILURE
  PMF    W.S.ELEV    OVER DAM     AC-FT       CFS        HOURS       HOURS        HOURS

  .50     1870.63      0.00       3679.      5500.       0.00        49.25         0.00
  .80     1872.82      0.00       4958.      9700.       0.00        48.25         0.00
  .90     1873.37      0.00       5356.     11073.       0.00        48.25         0.00
 1.00     1873.90      0.00       5754.     12431.       0.00        48.00         0.00
```

LIST OF REFERENCES

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2. "Unit Hydrograph Concepts and Calculations," by Corps of Engineers, Baltimore District (L-519).

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5. Handbook of Hydraulic, H. W. King and E. F. Brater, McGraw-Hill, Inc., New York, 1963.

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8. Weir Experiments, Coefficients, and Formulas, R. E. Horton, Water Supply and Irrigation Paper No. 200, Department of the Interior, United States Geological Survey, Washington, D. C., 1907.

9. "Probable Maximum Precipitation Susquehanna River Drainage Above Harrisburg, Pennsylvania," Hydrometeorological Report 40, prepared by H. V. Goodyear and J. T. Riedel Hydrometeorological Branch Office of Hydrology, U. S. Weather Bureau, U. S. Department of Commerce, Washington, D. C., May 1965.

10. Flood Hydrograph Package (HEC-1) Dam Safety Version, Hydrologic Engineering Center, U. S. Army Corps of Engineers Dams, California, July 1978.

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12. "Hydraulics of Bridge Waterways," BPR, 1970, Discharge Coefficient Based on Criteria for Embankment Shaped Weirs, Figure 24, page 46.

13. Applied Hydraulics in Engineering, Morris, Henry M. and Wiggert, James M., Virginia Polytechnic Institute and State University, 2nd Edition, The Ronald Press Company, New York, 1972.

14. Standard Mathematical Tables, 21st Edition, The Chemical Rubber Company, 1973, page 15.

15. Engineering Field Manual, U. S. Department of Agriculture, Soil Conservation Service, 2nd Edition, Washington, D. C. 1969.

APPENDIX D

PHOTOGRAPHS

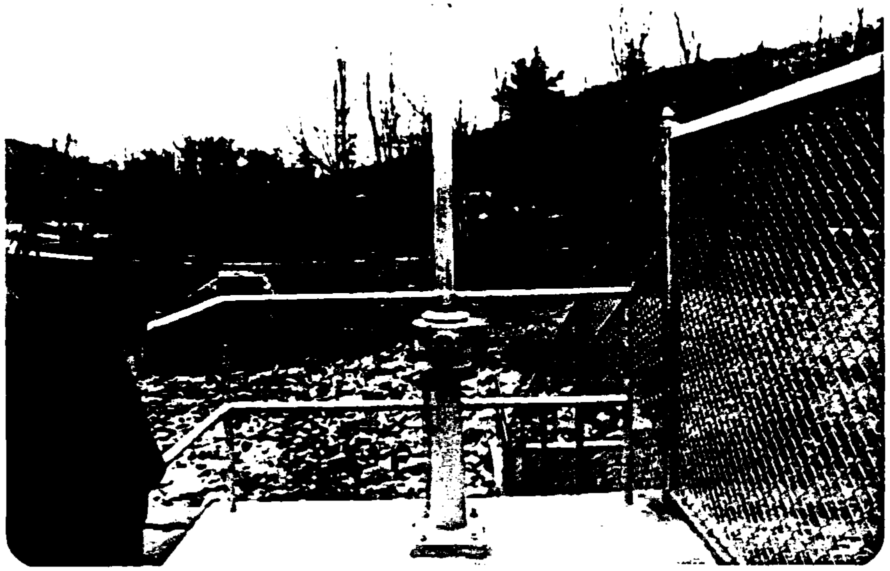
PHOTOGRAPH 1	Overview of Kephart Dam from a point just downstream from the crest on the left abutment. Note the emergency spillway at the right abutment (left center of photograph).
PHOTOGRAPH 2	View of the upstream portion of the dam, showing the low spot on the right abutment which serves as the emergency spillway.
PHOTOGRAPH 3	View from the dam centerline showing the discharge area of the emergency spillway.

1

2

3

PHOTOGRAPH 4	View of the manually operated gate control for the sluice gate located adjacent the right spillway wingwall.
PHOTOGRAPH 5	View of the riprap-lined channel and the bridge culvert 140 feet downstream of the stilling basin.
PHOTOGRAPH 6	View of a bridge over Kephart Lake approximately 1/4 mile upstream of the dam.



4

5

6

APPENDIX E

GEOLOGY

Geology

Kephart Dam is located approximately 4 miles west of the Allegheny Topographic Front within the Allegheny Mountain Section of the Appalachian Plateaus Physiographic Province. The Allegheny Mountain Section in this part of Pennsylvania is characterized by gently folded sedimentary rock strata of Pennsylvanian and Mississippian age. Major structural axes strike from southwest to northeast with flanking strata generally dipping from northwest to southeast.

The structural geology of the area has not been well studied; however, sufficient data is available to present the major features which characterize the area. South of the dam site are two high angle strike-slip faults (wrench faults) striking between N60°W and N70°W. The Shawville-Inburne fault which is the larger of the two cuts across the reservoir approximately 1,500 feet upstream of the dam. This fault can be traced eastward approximately four miles to near the edge of the Allegheny Topographic Front. Westward, the fault can be projected over the Hannah Furnace anticline northeast of Philipsburg where the fault trace continues to the northwest. The Shawville-Winburne fault is one of the longest traceable wrench faults in the area. The total length of this fault in the Appalachian Plateau is on the order of 22 miles.

Several miles southeast of the dam lies the Black Moshannon syncline. This structure seems to be of very low amplitude and trends in a southwest-northeast direction. The structure may terminate at the Shawville-Winburne fault southeast of the dam (see Geology Map).

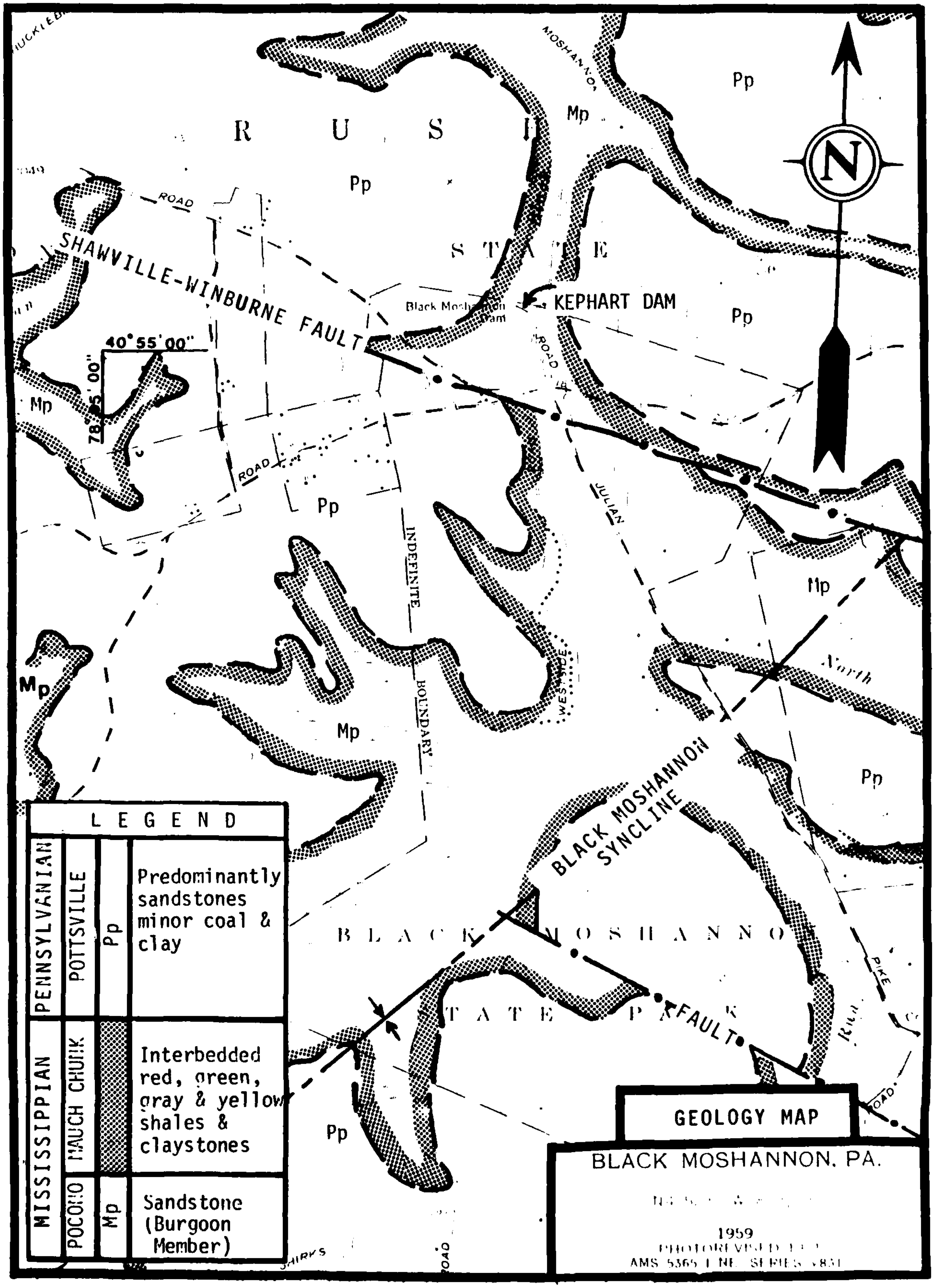
The bedrock geology in the immediate vicinity of the dam and reservoir consists of the Pottsville Group of lower Pennsylvanian age in the higher elevations and the Mauch Chunk and Pocono Formations of upper Mississippian age at lower elevations. The dam and reservoir are located entirely on the Pocono Formation. The Pottsville Group in this area is composed almost entirely of sandstone with some minor coal and clay. The Mauch Chunk is largely composed of red, green, gray, and yellow shales with some claystone and sandstone. The upper portion of the Pocono Formation consists of massive sandstone.

A series of core borings was provided along the dam centerline. They disclosed silty clays and silty sands overlying a sandstone (Pocono Formation). The depth to bedrock is approximately 17 to 20 feet below original ground.[2]

---

[1] Glass, Gary B, "Geology and Mineral Resources of the Philipsburg 7.5 Minute Quadrangle, Centre and Clearfield Counties, Pennsylvania," Harrisburg: Bureau of Topographic and Geologic Survey, Atlas 95a, 1972.

[2] Ellam, Joseph J., "Report Upon the Application of the Bureau of State Parks, Department of Environmental Resources," Harrisburg: DER I.D. No. 14-89-A, 1974.


N
R U S H
S T A T E
Pp
Mp
SHAWVILLE-WINBURNE FAULT
40°55'00"
78°05'00"
ROAD
MOSHANNON
Black Moshannon Dam
KEPHART DAM
JULIAN
INDEFINITE
BOUNDARY
WESTSIDE
North
BLACK MOSHANNON SYNCLINE
B L A C K M O S H A N N O N
S T A T E P A R K
FAULT
PIKE
Run
SHIRKS
LEGEND
PENNSYLVANIAN
POTTSVILLE
Pp
Predominantly sandstones minor coal & clay
MISSISSIPPIAN
MAUCH CHUNK
Interbedded red, green, gray & yellow shales & claystones
POCONO
Mp
Sandstone (Burgoon Member)
GEOLOGY MAP
BLACK MOSHANNON, PA.
1959
PHOTOREVISED
AMS 5365 I NE SERIES V831

APPENDIX F

FIGURES

LIST OF FIGURES

Figure	Description/Title
1	General Plan - Field Inspection Notes
2	Vicinity Plan
3	General Plan
4	Embankment Sections
5	Test Boring Results
6	Ogee Spillway Plan and Sections
7	Wall and Control Tower Details
8	Modification of Utilities

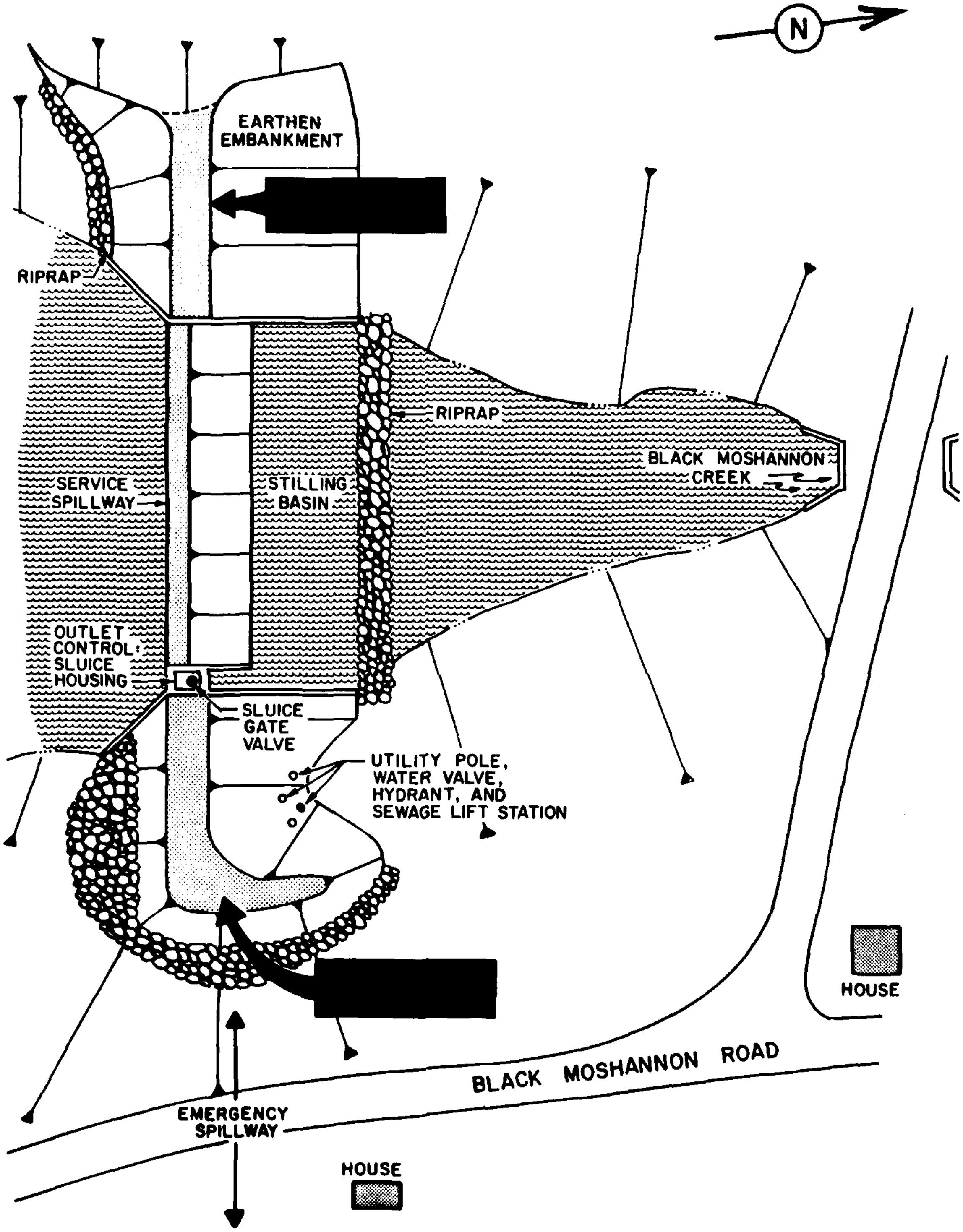
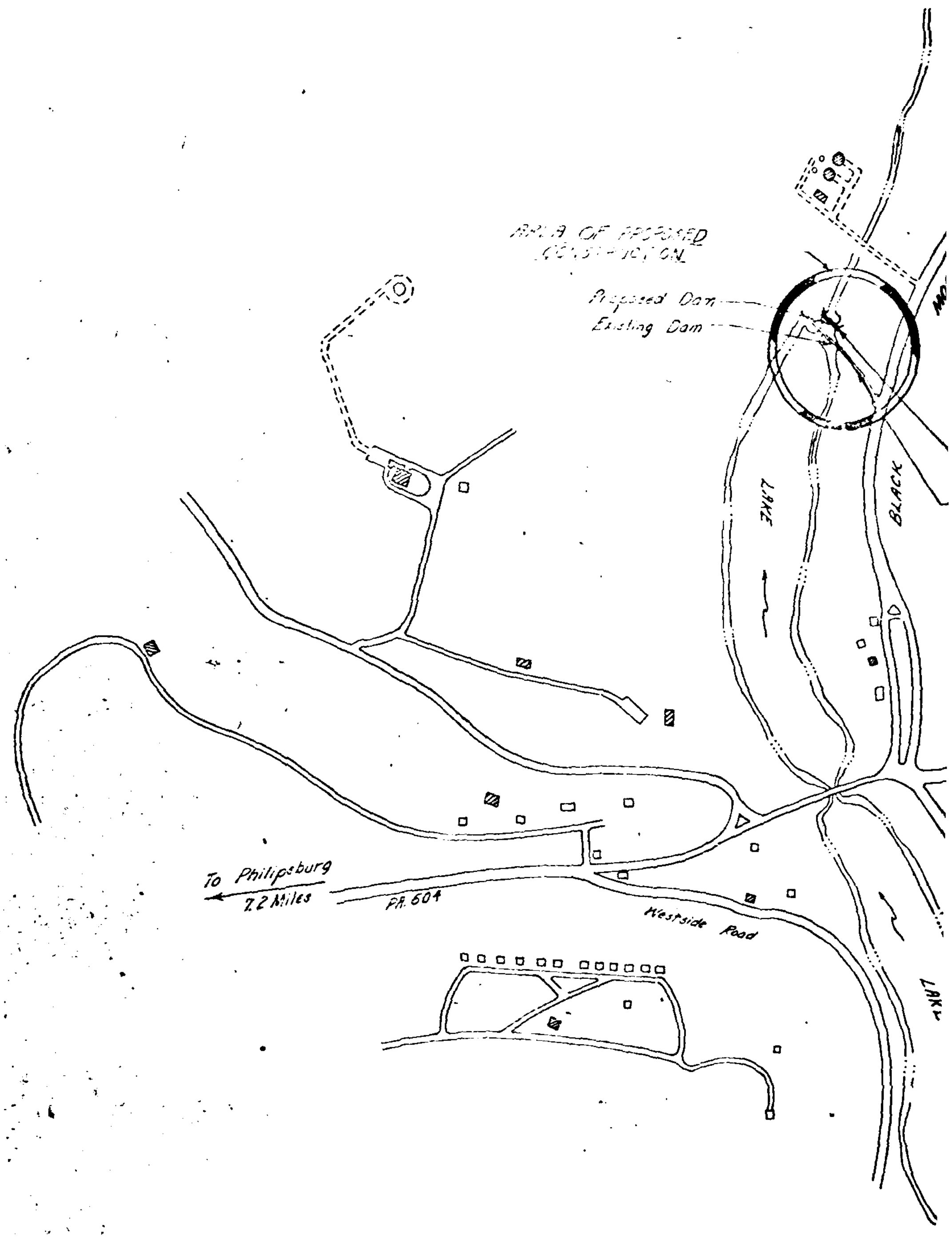
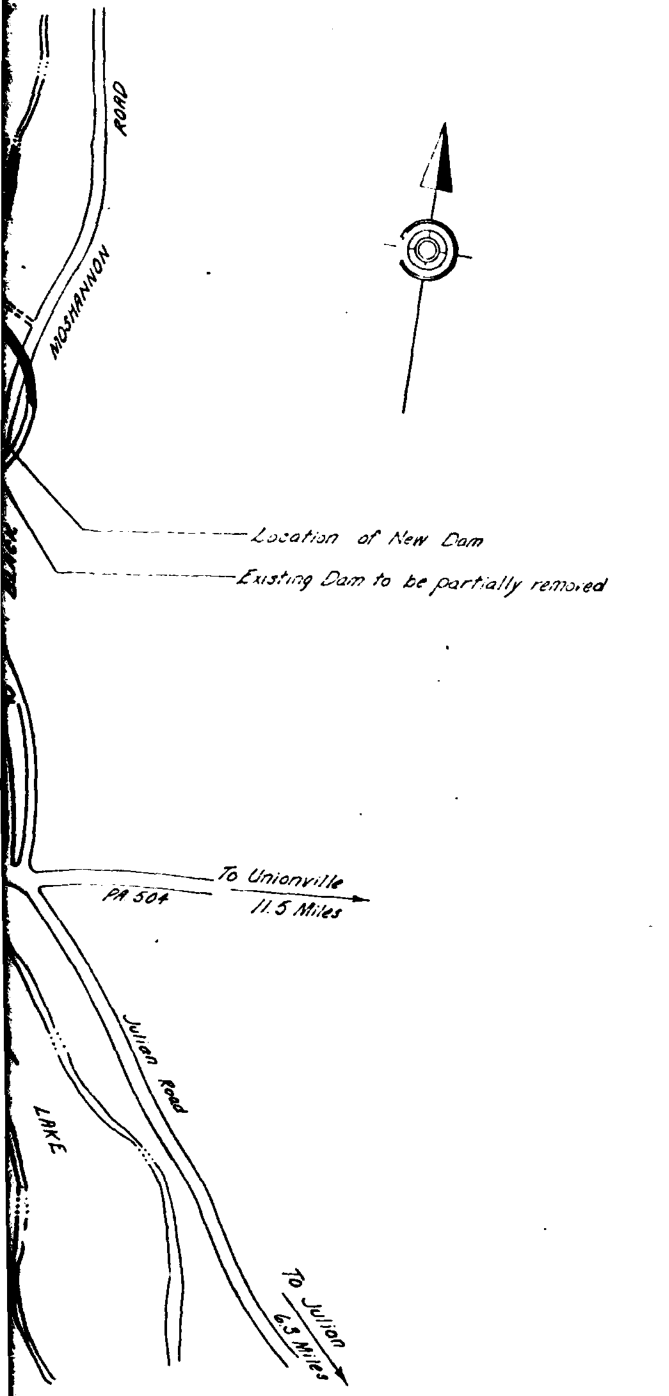

N
EARTHEN EMBANKMENT
[redacted]
RIPRAP
RIPRAP
BLACK MOSHANNON CREEK
SERVICE SPILLWAY
STILLING BASIN
OUTLET CONTROL: SLUICE HOUSING
SLUICE GATE VALVE
UTILITY POLE, WATER VALVE, HYDRANT, AND SEWAGE LIFT STATION
[redacted]
HOUSE
BLACK MOSHANNON ROAD
EMERGENCY SPILLWAY
HOUSE

FIGURE 1 - KEPHART DAM
GENERAL PLAN
FIELD INSPECTION NOTES


AREA OF PROPOSED CONSTRUCTION
Proposed Dam
Existing Dam
MO
LAKE
BLACK
To Philipsburg
7.2 Miles
P.R. 604
Westside Road
LAK

Scale: 1" = 200'


MOSHANNON ROAD
Location of New Dam
Existing Dam to be partially removed
To Unionville 11.5 Miles
PA 504
Julian Road
LAKE
To Julian 6.3 Miles

"All Dimensions and Existing Conditions shall be checked and verified by Contractor at the Site."

NO	DATE	REVISION	APPR
	10-17-75	"AS-BUILT"	

SUBMITTED Rodney V. Houseal
PROFESSIONAL

APPROVED J. L. McNaney
CHIEF-DIVISION OF RECREATIONAL FACILITIES

APPROVED
DIRECTOR - BUREAU OF DESIGN

RODNEY VINCENT HOUSEAL
No. 4754-E

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
OFFICE OF RESOURCES MANAGEMENT

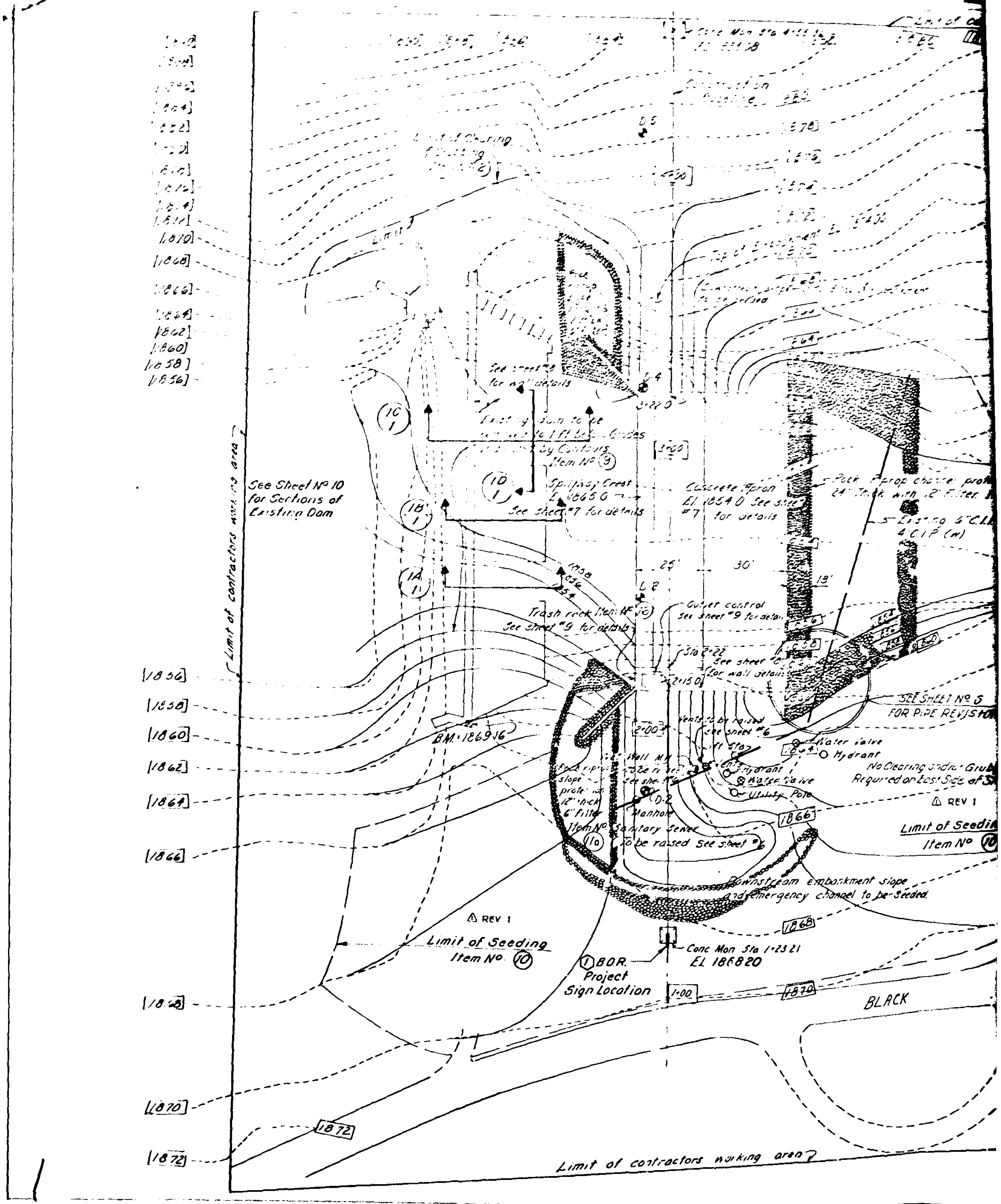
PROJECT NO. R14:3.1

KEPHART DAM
BLACK MOSHANNON STATE PARK
CONSTRUCTION
BLACK MOSHANNON CREEK - CENTRE COUNTY

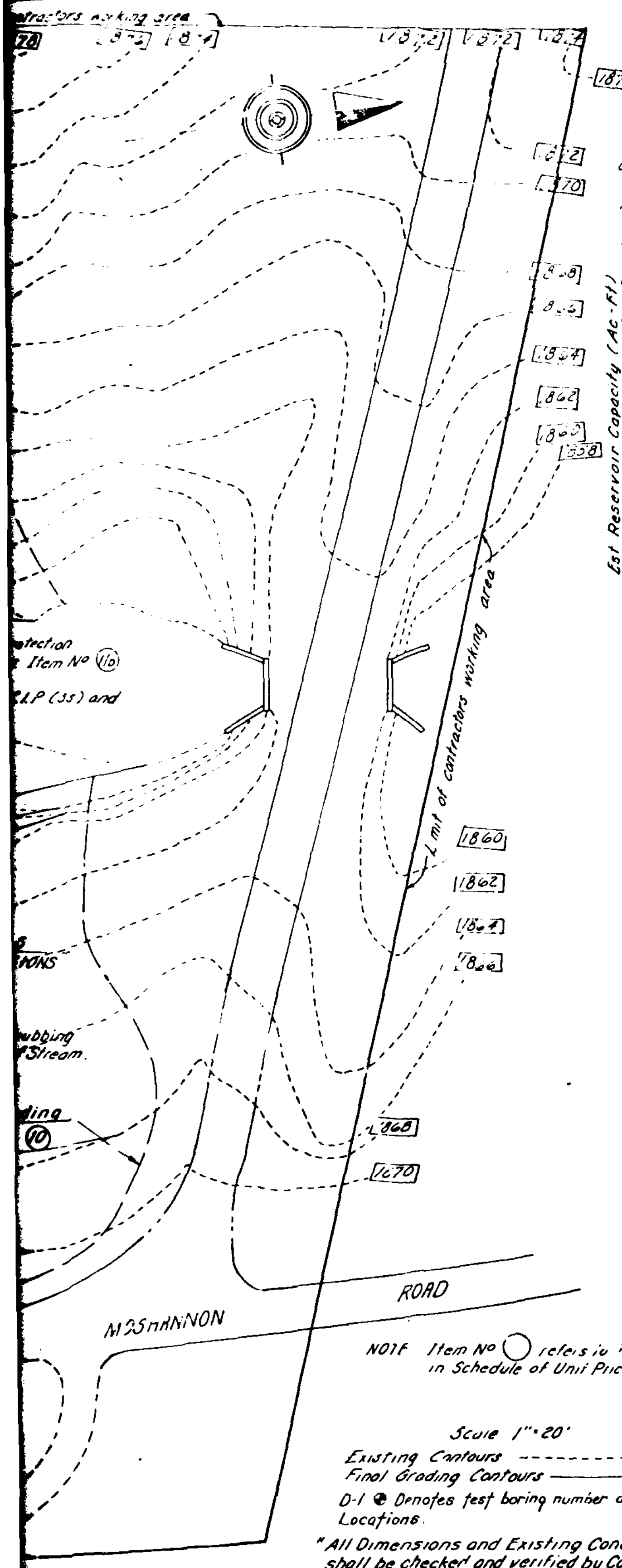
BERGER ASSOCIATES, INC.
Consulting Engineers
PO Box 1943 Harrisburg, Pa.

VICINITY PLAN

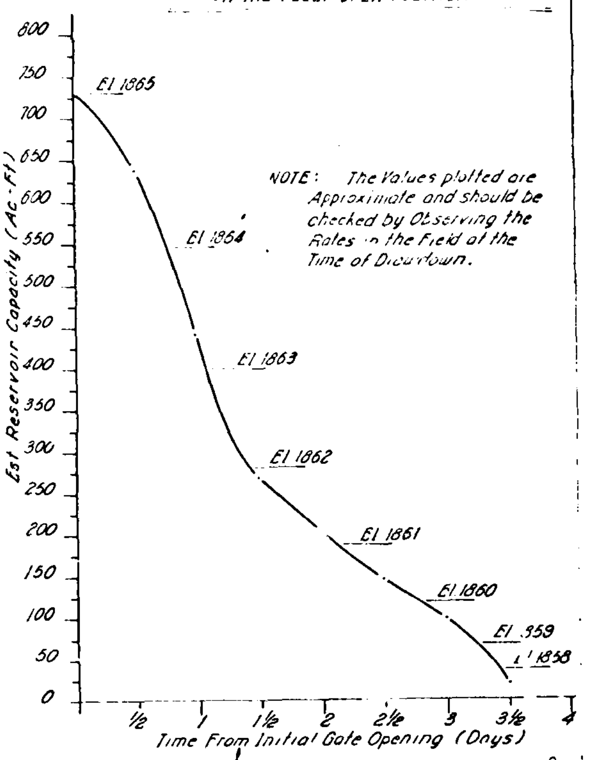
DRAWN BY J.H.H.	DATE Dec 1973	FIGURE 2
CHECKED BY E.M.L.	SCALE As shown	



Limit of contractors working area
See Sheet Nº 10 for Sections of Existing Dam
Limit of Clearing
See sheet #8 for wall details
Existing dam to be removed to 1 ft below Grades
Item Nº 9
Spillway Crest El 1865.0
See sheet #7 for details
Concrete Apron El 1854.0 See sheet #7 for details
Rock riprap channel protection 24" thick with 12" Filter
Existing 6" C.I.P.
4" C.I.P. (w)
Trash rack Item Nº
See sheet #9 for details
Outlet control See sheet #9 for details
Sta 2+22
See sheet #6 for wall details
2+15.0
2+00
3+00
Top of Embankment
Construction Baseline
Conc Mon Sta 4+55
25'
30'
13'
1A 1
1B 1
1C 1
1D 1
D.4
D.2
Vents to be raised see sheet #6
Wall MH to be raised
Hydrant
Water Valve
Utility Pole
Manhole
Sanitary Sewer to be raised See sheet #6
Rock riprap slope protection 12" thick 6" Filter
Item Nº 11a
SEE SHEET Nº 5 FOR PIPE REVISION
No Clearing and/or Grubbing Required on East Side of
REV 1
Limit of Seeding Item Nº 10
Downstream embankment slope and emergency channel to be Seeded
BM 1869.16
Conc Mon Sta 1+23.21 EL 1868.20
1 B.O.R. Project Sign Location
1+00
BLACK
Limit of contractors working area
1856
1858
1860
1862
1864
1866
1868
1870
1872


ntractors working area
70
1874
1870
1868
1866
1864
1862
1860
1858
Limit of contractors working area
tection
Item No 10
R.P (35) and
IONS
ubbing
Stream
ding
10
1860
1862
1864
1866
1868
1870
ROAD
MOSHANNON

W S ELEV & RESERVOIR CAPACITY vs TIME
for
LOWERING RESERVOIR, USING 4'x4' SLUICE GATE
AT THE FULLY OPEN POSITION



NOTE: The Values plotted are Approximate and should be checked by Observing the Rates in the Field at the Time of Drawdown.

① 10-17-75 Sign Location "AS-BUILT"

△ 3 1 74 Revisions as per Bulletin Nº 1

NOTE Item Nº ○ refers to item number in Schedule of Unit Prices Bid

Scale 1" = 20'

Existing Contours - - - - - - - - - - -
Final Grading Contours ————————
D-1 ◕ Denotes test boring number and Locations.

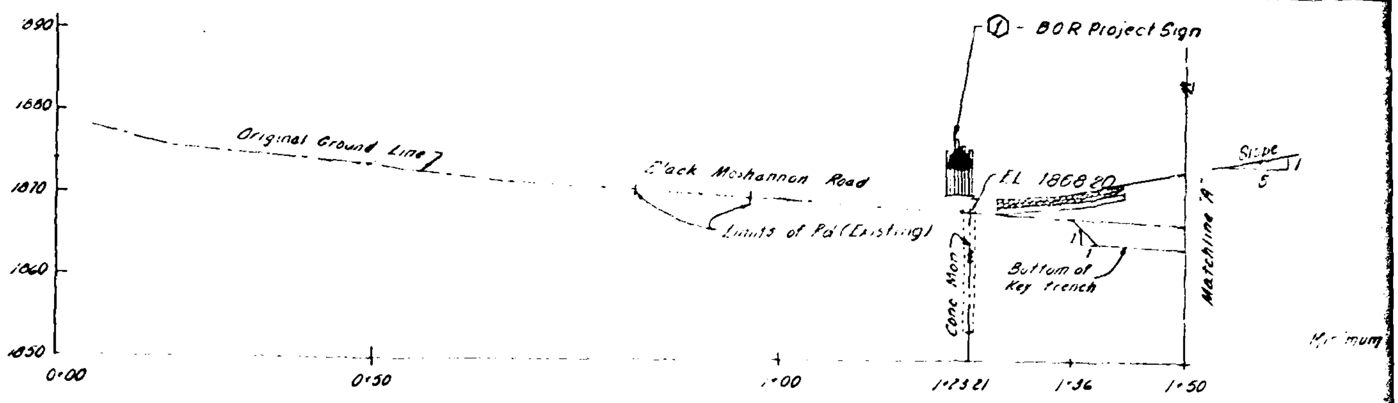
"All Dimensions and Existing Conditions shall be checked and verified by Contractor at the Site"

PROJECT NO R14-31
KEPHART DAM
BLACK MOSHANNON STATE PARK
CONSTRUCTION
BLACK MOSHANNON CREEK · CENTRE COUNTY
BERGER ASSOCIATES, INC

GENERAL PLAN

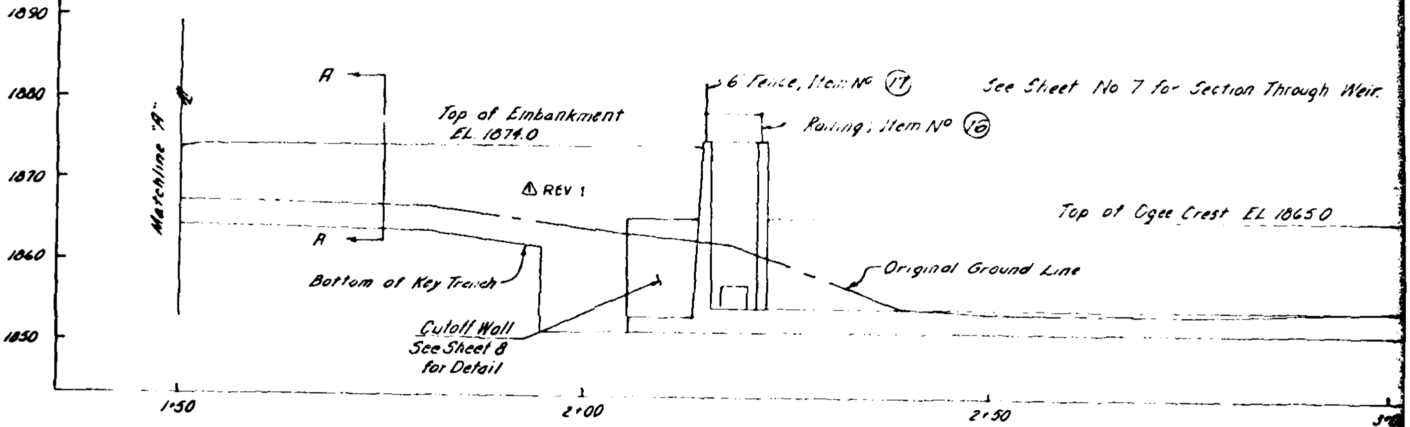
JHH Dec. 1973
EML

FIGURE 3


1890
1880
1870
1860
1850
① - BOR Project Sign
Original Ground Line
Black Moshannon Road
Limits of Rd (Existing)
EL 1868.20
Slope 1 / 5
Conc Mon
Bottom of Key Trench
Matchline "A"
Minimum
0+00
0+50
1+00
1+23.21
1+36
1+50

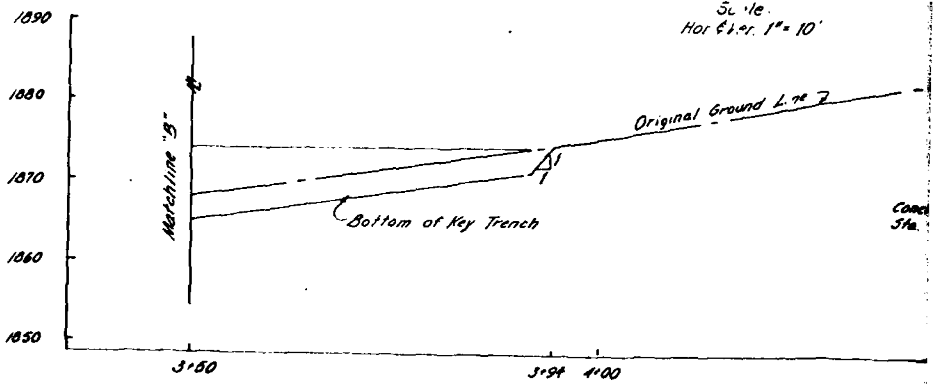
PROFILE CONST. ℄

Scale:
Hor & Ver 1" = 10'


1890
1880
1870
1860
1850
Matchline "A"
A
A
Top of Embankment EL 1874.0
⚠ REV 1
6' Fence, Item No ⑰
Railing; Item No ⑯
See Sheet No 7 for Section Through Weir.
Top of Ogee Crest EL 1865.0
Bottom of Key Trench
Original Ground Line
Cutoff Wall
See Sheet 8 for Detail
1+50
2+00
2+50

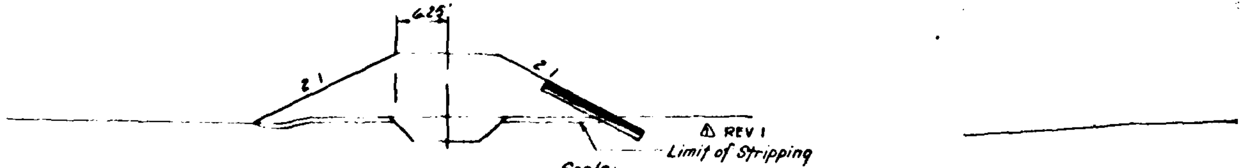
PROFILE CONSTRUCTION ℄ CON'T

Scale:
Hor & Ver. 1" = 10'


1890
1880
1870
1860
1850
Matchline "B"
Original Ground Line
Bottom of Key Trench
1
1
3+50
3+94
4+00

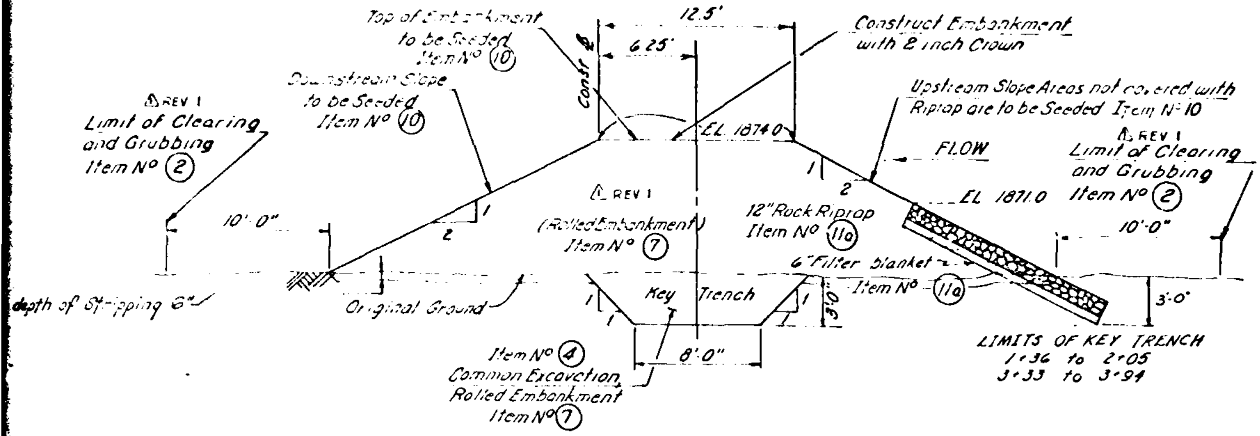
PROFILE CONSTRUCTION ℄ CON'T

Scale:
Hor & Ver 1" = 10'

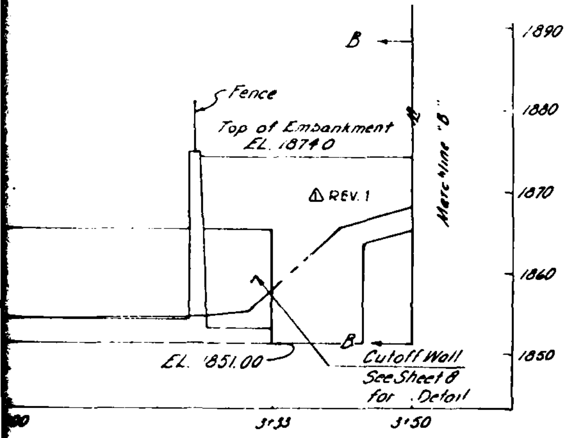

6.25'
2:1
2:1
⚠ REV 1
Limit of Stripping

Section A A Sta 1+75

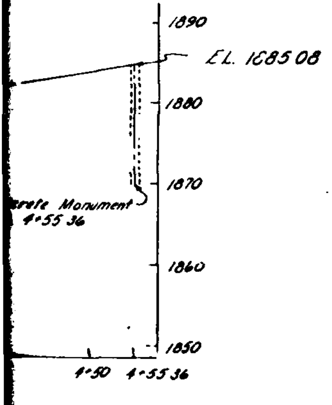
Scale
Hor & Ver 1" = 10'


Top of Embankment to be Seeded Item N° ⑩
12.5'
6.25'
Constr ℄
Construct Embankment with 2 inch Crown
Downstream Slope to be Seeded Item N° ⑩
Upstream Slope Areas not covered with Riprap are to be Seeded Item N° 10
REV 1
Limit of Clearing and Grubbing Item N° ②
EL. 1874.0
FLOW
REV 1
Limit of Clearing and Grubbing Item N° ②
1
2
EL 1871.0
REV 1
10'-0"
1
2
(Rolled Embankment) Item N° ⑦
12" Rock Riprap Item N° ⑪a
10'-0"
6" Filter blanket
Item N° ⑪a
depth of Stripping 6"
Original Ground
Key Trench
1
1
1
1
3'0"
3'-0"
Item N° ④ Common Excavation, Rolled Embankment Item N° ⑦
8'-0"
LIMITS OF KEY TRENCH
1+36 to 2+05
3+33 to 3+94

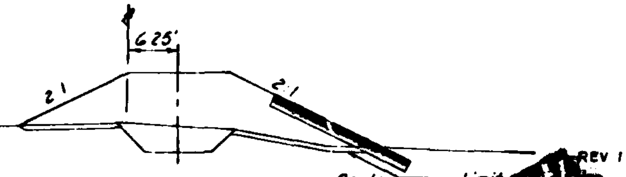
TYPICAL EMBANKMENT
SECTION
Scale 1" = 5'-0"


B
B
1890
1880
1870
1860
1850
Fence
Top of Embankment EL. 1874.0
℄
Match line "B"
REV. 1
EL. 1851.00
Cutoff Wall See Sheet 8 for Detail
3+33
3+50

NOTE: Item N° ○ refers to item number in Schedule of Unit Prices Bid


1890
EL. 1885.08
1880
1870
1860
1850
Concrete Monument
4+55.36
4+50
4+55.36

"All Dimensions and Existing Conditions shall be checked and verified by Contractor at the Site."


℄
6.25'
2:1
2:1
Limit
REV 1

Section B-B Sta. 3+50

Scale: Hor & Ver 1" = 10'

NO	DATE	REVISION	APPR
①	10.11.75	BOR Project Sign "AS-BUILT"	
△	9.1.74	Revisions as per Bulletin N° 1	JLM

SUBMITTED

PROFESSIONAL

APPROVED

CHIEF DIVISION OF RECREATIONAL FACILITIES

APPROVED

DIRECTOR BUREAU OF DESIGN

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
OFFICE OF RESOURCES MANAGEMENT

PROJECT NO. R14:3.1

KEPHART DAM
BLACK MOSHANNON STATE PARK
CONSTRUCTION
BLACK MOSHANNON CREEK - CENTRE COUNTY

BERGER ASSOCIATES, INC.
Consulting Engineers
PO Box 1943 Harrisburg, Pa

LONGITUDINAL SECTION
EMBANKMENT CROSS SECTIONS
TYPICAL SECTION

DRAWN BY J.H.H.	DATE Dec. 1973	FIGURE 4
CHECKED BY E.M.L.	SCALE As shown	

BORING NO D-2

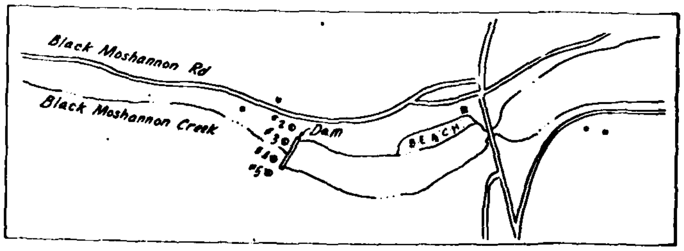
A	B		EL 1866.5
1	10	Topsoil	1866.0
2	10	Lt. Brown silty fine sand-damp	
3	10		1864.5
4	12	Lt Brown silty fine sand trace of fine gravel-moist	
5	18		
6	19		1860.5
7	19	Lt. Brown fine sandy clayey silt - trace of gravel-moist	
8	20		
9	18		1856.8
10	50		
11	59		
12	59	Lt reddish brown silty sand and rock fragments very moist	
13	36		
14	64		
15	29		
16	28		
17	19		
18	24		1848.5
19	52		
20	70	Multi-colored sand and rock fragments very moist	
21	43		
22	56		
23	40		
24	51		
25	45		1841.5
26	150	Multi-colored highly decomposed sandstone	
27	55		1840.5
28	67		
29	53		
30	78		
31	48		
32	81	Lt. brown and red sand rock fragments - moist	
33	147		
34	69		
35	81		
36	177		
37	73		
38	154		
39	46		
40	50		
41	61		
42	83		
43	67		
44	2465		1823.0
45		Gray sandstone boulder	1821.5
46		Gray silty sandy clay and rock fragments	
47			1819.5
48	6	Light brown silty sand and rock fragments - wet	
49	33		
50	69		
51	123		1815.5
52			
53	95%	Gray sandstone moderately broken - hard	
54			
55			
56			
57	100%		1809.5
58		Gray sandstone - badly to moderately broken - hard	
59			
60			
61	95%		1805.5

BORING NO D-3

A	B		EL 1854.1
1	6	Sand and cobbles	
2	7		1852.1
3	6	Grayish brown sand and rock fragments - wet silty	
4	4		
5	18		
6	16		1848.1
7	10	Grayish brown sand and rock fragments - wet	
8	20		
9	21		
10	27		1844.1
11	52		
12	39		
13	37		
14	36	Grayish brown and red sand and rock fragments - traces of silt - wet	
15	31		
16	23		
17	17		
18	39		
19	16		
20	47		
21	51		
22	58		1832.1
23	37	Grayish brown and red sand and rock fragments - little clayey silt - wet	
24	61		
25	54		
26	48		1828.1
27	39	Grayish brown and red clayey silty sand and rock fragments. With rounded gravel - very moist	
28	51		
29	60		
30	76		
31	69		
32	61		1822.1
33	75/.1	Lt reddish gray sandstone - badly to moderately broken.	
34	69/.1		
35	86%		1818.6
36			
37			
38		Gray sandstone moderately broken with badly broken zones	
39	98%		
40			
41			
42			
43			
44	94%		1810.1
45		Gray sandstone - Slightly to moderately broken	
46			
47			
48			1806.1
49	49%	Gray sandstone and shale cong. mod. to badly broken	
50			1804.5
51		Gray sandstone and shale cong. - badly broken - wthd. and seamy	
52			
53	55%		1801.1
54		Gray sandstone and shale cong. moderately broken	
55			1800.1
56			
57	95%	Gray sandstone - moderately broken and seamy	
58			
59			
59.7	100%		1794.4

BORING NO D-4

A	B		EL 1855.0
1	14	Grayish brown clayey silty sand with rock fragments - moist	
2	31		
3	24		
4	34		1851.0
5	28	Grayish brown silty sand and rock fragments - moist	
6	43		
7	33		
8	34		1847.0
9	29	Lt. brown and red silty sand with rock fragments - moist	
10	56		1845.0
11	22	Grayish brown silty clay and sand with rock fragments - very moist	
12	40		
13	37		
14	22		
15	15		
16	22		1839.0
17	65		
18	47		
19	31	Lt brown and red silty sand and rock fragments - moist to very moist	
20	37		
21	40		
22	53		
23	52		
24	92		
25	52		
26	93		
27	125		1828.0
28		Red sandstone - moderately broken	
29	97%		
30			1824.7
31		Gray sandstone with shale - few pyrite cavities	
32			
33			1822.9
34		Red sandstone moderately to badly broken with pyrite cavities	
35	89%		1819.8
36		Gray sandstone with streaks of shale and red sandstone - moderately broken	
37			
38			
39			
40			
41	100%		1814.0
42		Gray sandstone moderately broken (43.8 - 44.1 sandstone cong. with pyrite - badly weathered)	
43			
44			
45			
46	98%		1808.5
47		Red sandstone conglomerate	
48			
49			1806.4
50			
51	100%	Gray sandstone slightly broken	
52			
53			
54			1801.5
55		Gray sandstone and shale cong. moderately to badly broken	
56	100%		
57			
58			
59			1796.5
60	95%	Gray sandy shale mod. broken and seamy	1795.0



Boring Location Sketch

BORING NO D-5

A	B	Description	El.
			EL. 1878.6
		Topsoil El. 1878.1	
1	2	Lt Brown clayey silt little sand	
2	28	and rock fragments moist	1876.6
3	45		
4	61		
5	47	Lt brown and reddish gray silty	
6	91	sand and rock fragments damp	
7	54		
8	102		
9	118		
10	88		1868.6
11	42	Lt brown and reddish gray clayey	
12	42	silty sand and rock fragments	
13	85	very moist	1865.1
14	[illegible]		
15		Brown sandstone boulder	
16			
17			1861.6
18	15	Lt brown and reddish gray clayey	
19	17	silty sand with rock frags very moist	
20	97/5		1859.1
21			
22			
23	71%	Red and gray sandstone moderately	
24		to badly broken and seamy	
25	100%		
26			
27			
28			
29			
30	54%		1848.6
31		Brown sandstone badly broken	
32	53%	Seamy	1847.1
33		Gray sandstone with shale and	
34		pyrite moderately broken	1844.4
35			
36		Red sandstone moderately broken	
37	100%		
38			1841.4
39		Lt Gray sandstone moderately to	
40		badly broken and seamy	
41			
42	84%		1837.1
43			
44		Gray sandstone slightly broken	
45		and seamy	
46			
47	96%		
48			
49		Lost drill water at 51.0'	
50			
51			
52	100%		1827.1
53		Gray sandstone broken	
54			
55			
56			
57	100%		1822.1
58		Gray sandstone	
59			
60	100%		1818.6

Column A denotes depth in feet
Column B denotes number of blows per foot on Sample Spoon or percentage of core recovery.

"All Dimensions and Existing Conditions shall be checked and verified by Contractor at the Site."

NO	DATE	REVISION	APPR
	10-17-75	"AS-BUILT"	

SUBMITTED Rodney V. Houseal
PROFESSIONAL

APPROVED J. L. McNaney
CHIEF DIVISION OF RECREATIONAL FACILITIES

APPROVED
DIRECTOR BUREAU OF DESIGN

RODNEY VINCENT HOUSEAL

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
OFFICE OF RESOURCES MANAGEMENT

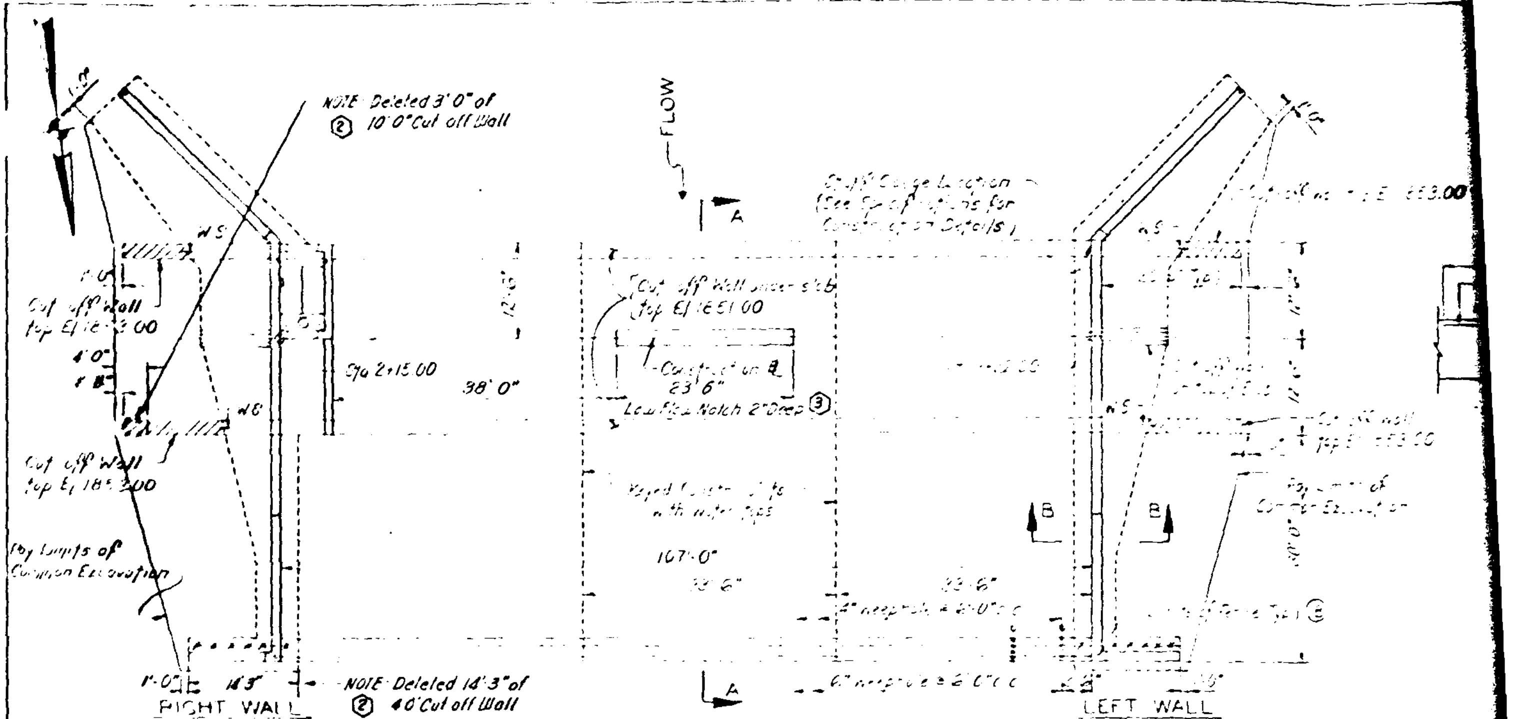
PROJECT NO. R14:3.1

KEPHART DAM
BLACK MOSHANNON STATE PARK
CONSTRUCTION
BLACK MOSHANNON CREEK - CENTRE COUNTY

BERGER ASSOCIATES, INC.
Consulting Engineers
PO Box 1943 Harrisburg, Pa

TEST BORING RESULTS

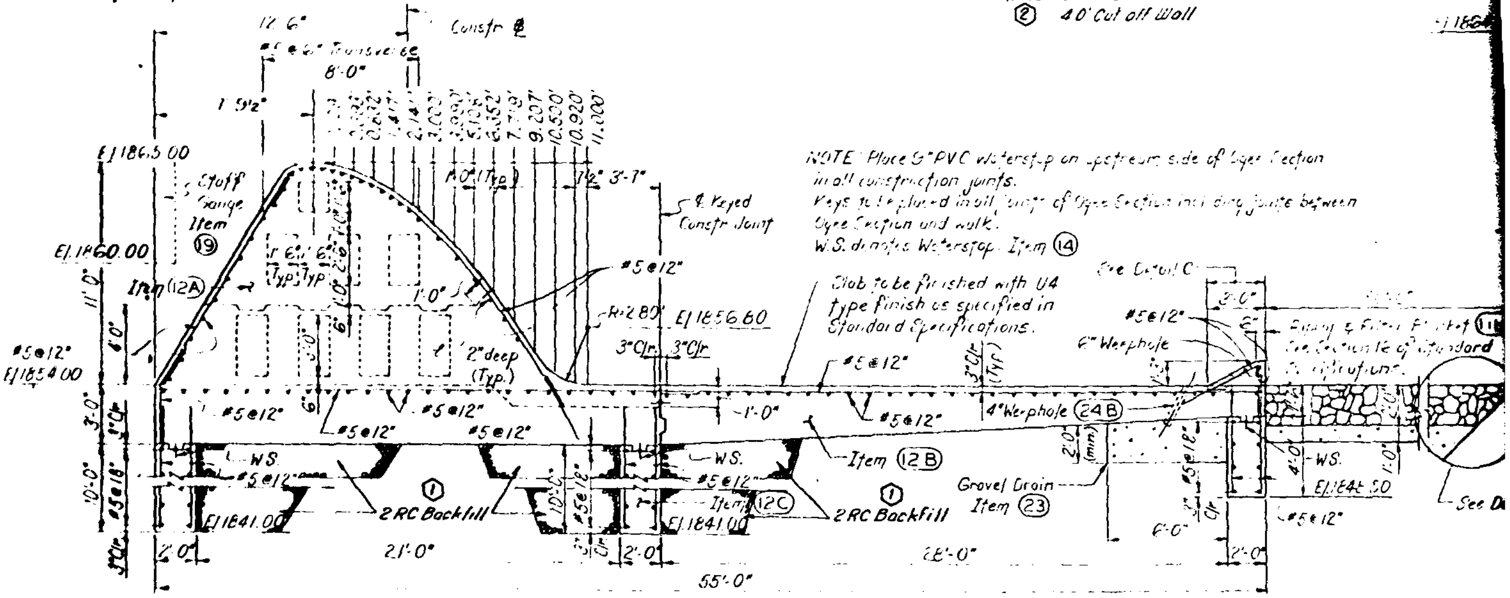
DRAWN BY JHH	DATE Dec. 1973	FIGURE 5
CHECKED BY E.M.L.	SCALE As shown	


NOTE: Deleted 3'0" of ② 10'0" Cut off Wall
FLOW
A
Cut off Wall top El 18 .00
Cut off Wall top El 18 .00
Pay Limits of Common Excavation
Sta 2+15.00
38'0"
Cut off Wall under slab top El 1851.00
Construction ℄ 23'6"
Low Flow Notch 2" Deep ③
Keyed Construction Joints with waterstops
107'-0"
33'-6"
33'-6"
6" weepholes @ 8'-0" c.c.
B
B
Pay Limits of Common Excavation
1'-0"
14'3"
RIGHT WALL
NOTE: Deleted 14'3" of ② 4'0" Cut off Wall
LEFT WALL
14'3"
NOTE: Deleted this Portion of ② 4'0" Cut off Wall
W.S.
W.S.

GENERAL PLAN Δ1

Scale 3/32" = 1'-0"

NOTE: All Keys in Ogee are 3" x 1'6".

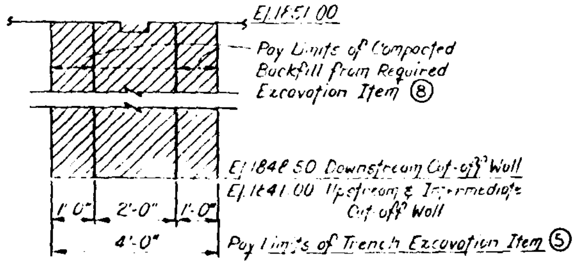

12'6"
Constr ℄
#5 @ 6" Transverse
8'-0"
1'9½"
El 1865.00
Staff Gauge Item ⑲
El 1860.00
Item (12A)
#5@12"
El 1854.00
1'0"
R=2.80'
El 1856.60
3" Clr
3" Clr
2" deep (Typ.)
#5@12"
NOTE: Place 6" PVC waterstop on upstream side of Ogee Section in all construction joints.
Keys to be placed in all joints of Ogee Section including joints between Ogee Section and walk.
W.S. denotes Waterstop Item ⑭
Slab to be finished with U4 type finish as specified in Standard Specifications.
See Detail C
6" Weephole
4" Weephole (24B)
Item (12B)
Item (12C)
2 RC Backfill
2 RC Backfill
Gravel Drain Item ㉓
El 1841.00
El 1841.00
El 1848.50
W.S.
2'-0"
21'-0"
28'-0"
55'-0"
6'-0"
2'-0"
10'-0"
11'-0"

SECTION A A Δ1

Scale 1/4" = 1'-0"

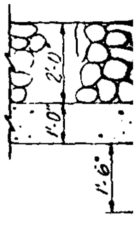
CONCRETE ITEMS Δ1

12A - OGEE SECTION
12B - SLAB
12C - CUT-OFF WALLS
12D - SPILLWAY WALLS
& FOOTINGS


El 1851.00
Pay Limits of Compacted Backfill from Required Excavation Item ⑧
El 1848.50 Downstream Cut-off Wall
El 1841.00 Upstream & Intermediate Cut-off Wall
1'0"
2'-0"
1'-0"
4'-0"
Pay Limits of Trench Excavation Item ⑤

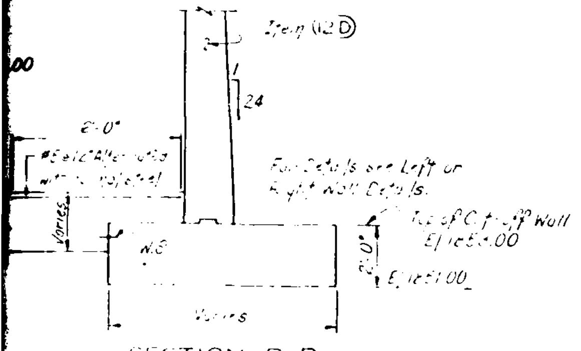
TRENCH EXCAVATION Δ1

Scale 1/2" = 1'-0"



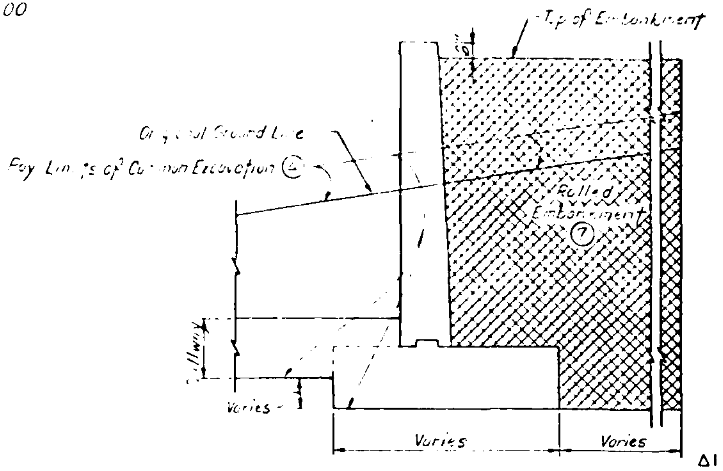
GENERAL STRUCTURAL NOTES

- All concrete to be Class A Concrete (f'c=3,000 psi) ⑫.
- All reinforcing steel to be A 615-40 ⑬.
- All structural steel to be A-36 except as noted.
- Backfill of cut off wall to be compacted thoroughly before slab is poured.
- Minimum cover on reinforcing steel to be 3" except as noted.
- All concrete surfaces shall be finished in accordance with F1 or F2 types as specified in Standard Specifications.
- All exposed concrete edges to have a 3/4" chamfer.
- ○ Denotes bid item no. in the bid form schedule of prices.


Item (12D)
24
8'-0"
#5@12" Alternate with ...
Varies
For Details see Left or Right Wall Details.
Top of Cutoff Wall El 1854.00
El 1851.00
2'-0"
Varies

SECTION B B Δ1

No Scale

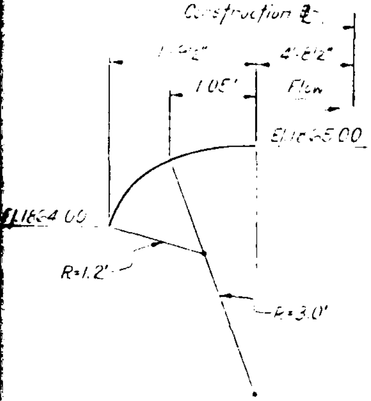

Top of Embankment
Original Ground Line
Pay Limits of Common Excavation ②
Rolled Embankment ⑦
Varies
Varies
Varies

Δ1

PAY LIMITS OF EXCAVATION & EMBANKMENT

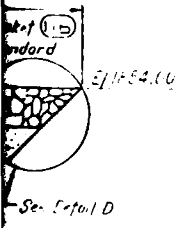
No Scale

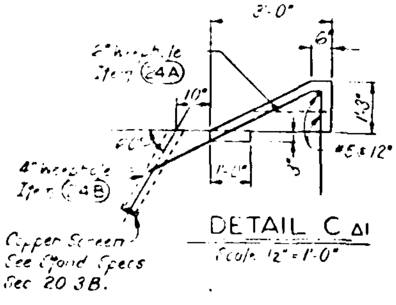
See General Plan this Drawing.


Construction ℄
4'-8½"
1.05'
Flow
El 1855.00
El 1854.00
R=1.2'
R=3.0'

OGEE CREST SHAPE

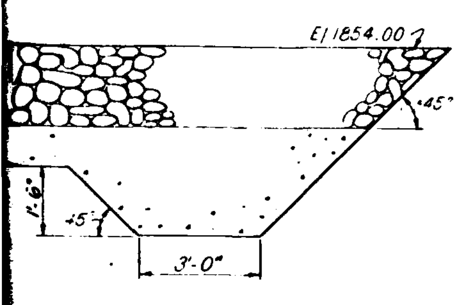
No Scale


(1-D)
El 1854.00
See Detail D


3'-0"
6"
2" weephole Item (24A)
10"
60°
1'-3"
#5@12"
4" weephole Item (24B)
1'-0"
3"
Copper Screen See Stand. Specs Sec. 20.3B.

DETAIL C Δ1

Scale ½"=1'-0"


El 1854.00
45°
1'-6"
45°
3'-0"

DETAIL D

Scale ½"=1'-0"

"AS BUILT"

NOTES:
1. Low Flow Notch Constructed 2" Deep x 23'6" Long.
2. 2RC Stone was used as Backfill at the Upstream & Downstream Cutoff Walls.

NO	DATE	REVISION	APPR
①	10-11-75	Added 2RC Backfill "AS-BUILT"	
②	10-11-75	Deleted Cut off Wall as Noted "AS-BUILT"	
③	10-11-75	Added Low Flow Notch "AS-BUILT"	
Δ1	3/11/74	Revised as per Bulletin No. 1	JLM

SUBMITTED Rodney V. Rousseal
PROFESSIONAL

APPROVED J. L. McNaney
CHIEF DIVISION OF RECREATIONAL FACILITIES

APPROVED
DIRECTOR BUREAU OF DESIGN

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
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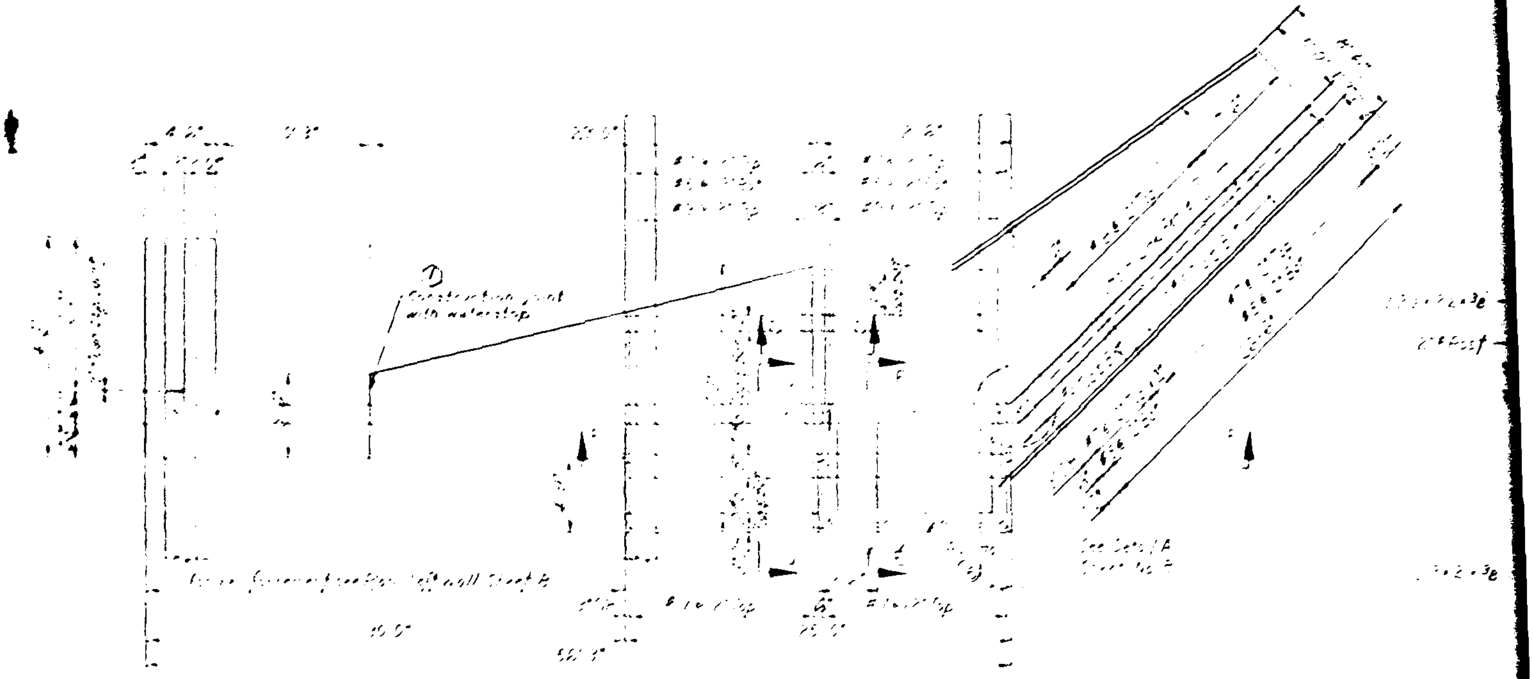
PROJECT NO. R14 3.1

KEPHART DAM
BLACK MOSHANNON STATE PARK
CONSTRUCTION
BLACK MOSHANNON CREEK - CENTRE COUNTY

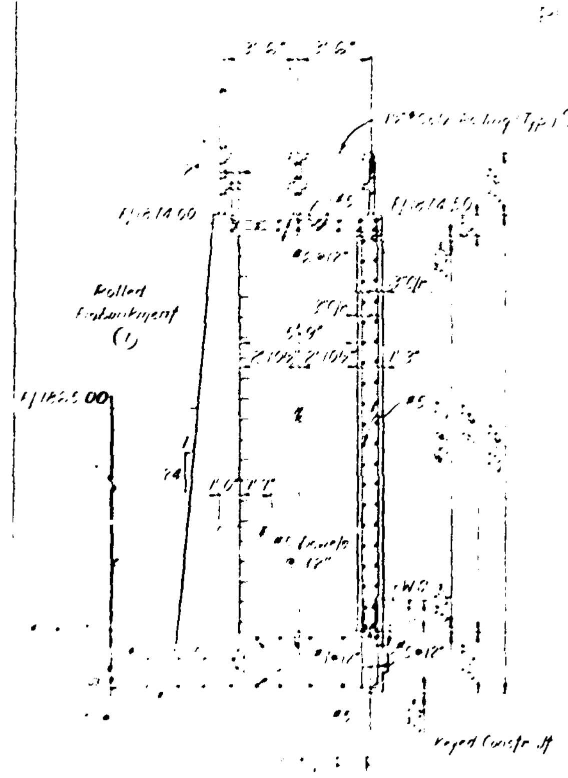
BERGER ASSOCIATES, INC.
Consulting Engineers
PO Box 1943 Harrisburg, Pa

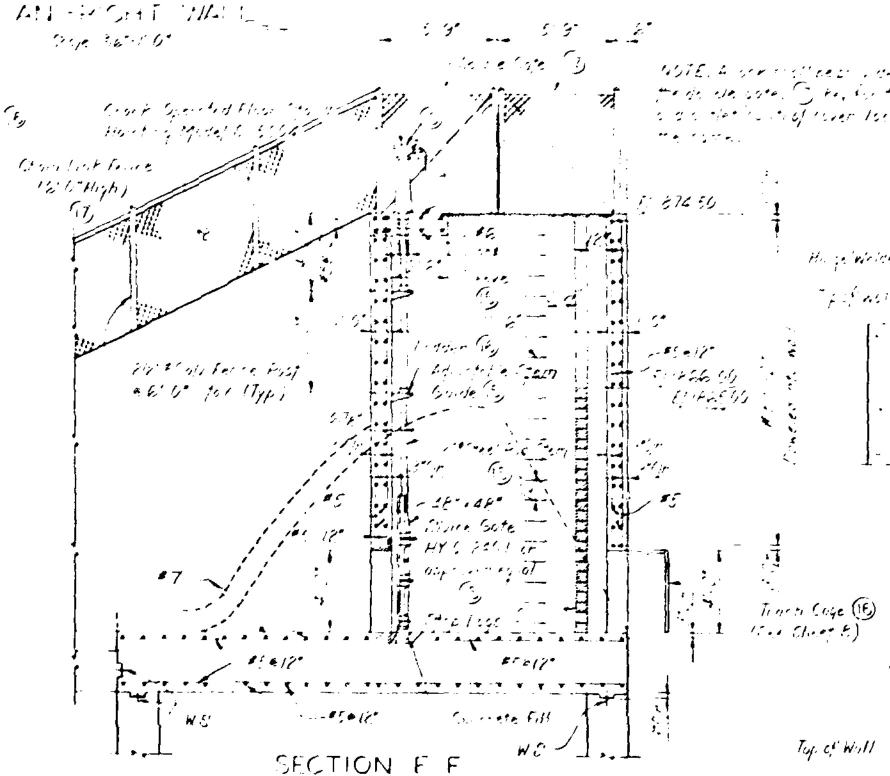
OGEE SPILLWAY PLAN AND SECTIONS

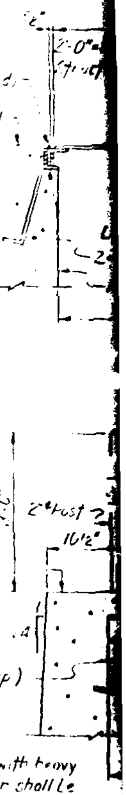
DRAWN BY	DATE Dec. 1973	FIGURE 6
CHECKED	SCALE As shown	


Construction joint with waterstop
See Sect A Sheet No. 8
2" Post
10'-0"
56'-0"

PLAN RIGHT WALL
Scale 3/8"=1'-0"


3'-6"
3'-6"
1½" Galv. Railing Typ.
El. 614.00
El. 614.50
Rolled Embankment
El. 605.00
#5
#5 Levels @ 12"
W.S.
#5 @ 12"
Keyed Constr. Jt.


Sluice Gate
Chain Link Fence (6'-0" High)
2½" Galv. Fence Post @ 6'-0" c/c (Typ.)
El. 614.50
#5 @ 12"
El. 606.00
48"×48" Sluice Gate
#7
#5
#5 @ 12"
Concrete Fill
W.S.
Trench Cage (See Sheet 5)
2" Post
Top of Wall

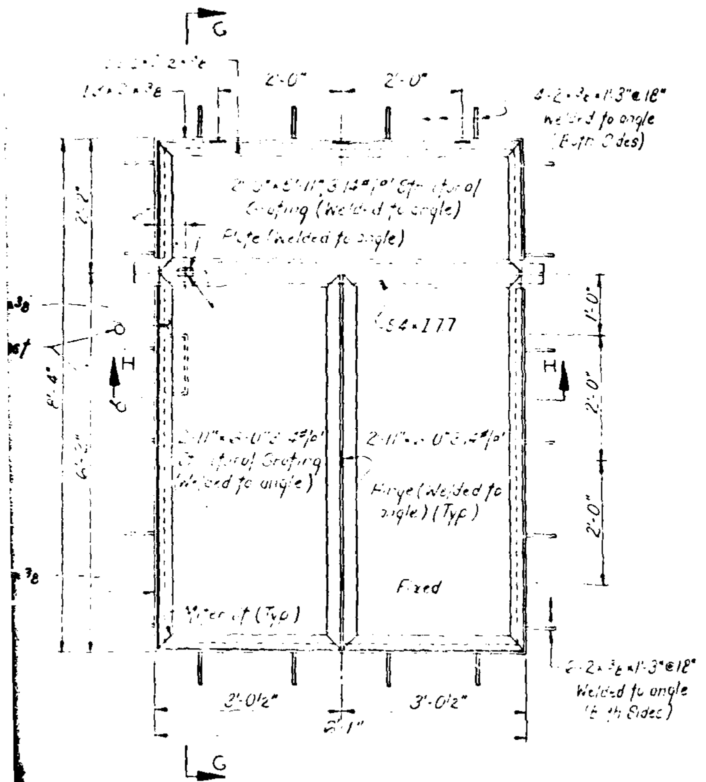

2'-0"
Hinge Welded
2"×2"×1'-3" @ 16" Welded (Typ.)

SECTION E-E
Scale ¼"=1'-0"

NOTES

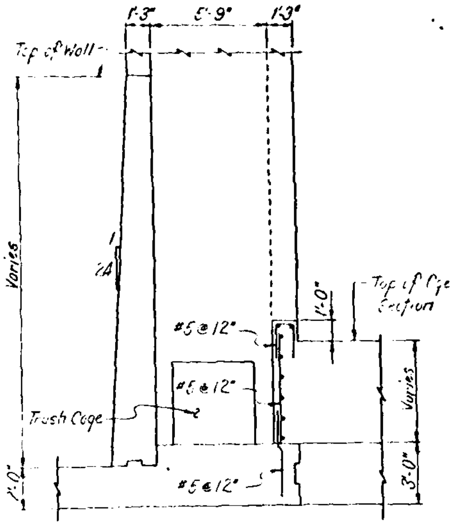
- For General Structural Notes see Sheet 7.
- Legend W.S. denotes Waterstop
- For Section D-D see Sheet 8.
- Model nos. given for sluice gate and hoist are by the Rodney Hunt Company

NOTE:
The hinged sections of grating shall be provided with heavy galvanized steel lift rings. The stock diameter shall be ½" and the inside diameter of the ring shall be 4". The ring shall be attached to the grating by a 6" length of ½" chain welded to the grating and ring.


G
2'-0"
2'-0"
2-2×3/8×1'-3"@18" Welded to angle (Both Sides)
2'-0"×5'-11",3.14#/□' Structural Grating (Welded to angle)
Plate (Welded to angle)
S4×7.7
H
H
2'-11"×6'-0",3.14#/□' Structural Grating (Welded to angle)
2'-11"×6'-0",3.14#/□'
Hinge (Welded to angle) (Typ.)
1'-0"
2'-0"
2'-0"
Fixed
Miter cut (Typ.)
2-2×3/8×1'-3"@18" Welded to angle (Both Sides)
2'-0½"
3'-0½"
2'1"
G

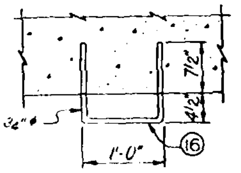
OUTLET CONTROL COVER ⑯

Scale: ¾"=1'-0"


1'-3"
5'-9"
1'-3"
Top of Wall
Varies
1
24
Top of Ogee Section
1'-0"
#5@12"
#5@12"
Trash Cage
Varies
#5@12"
1'-0"
3'-0"

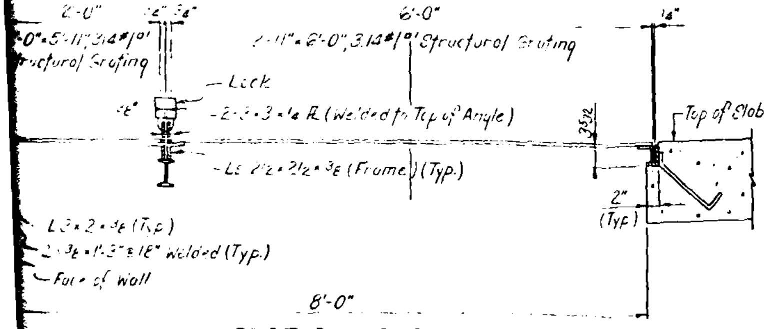
SECTION J J

Scale ¼"=1'-0"



DETAIL OF LADDER RUNGS

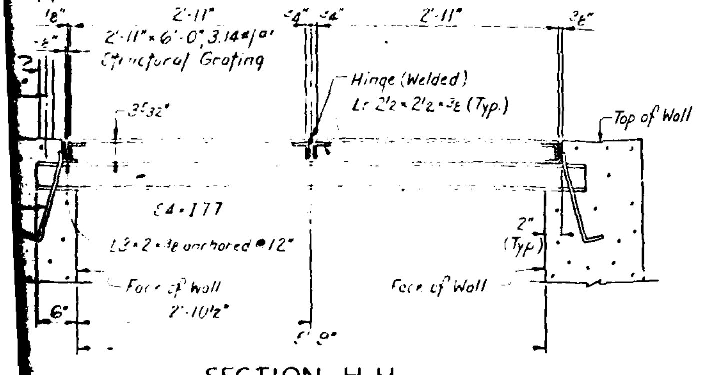
Scale: 1"=1'-0"


2'-0"
6'-0"
¼"
2'-0"×5'-11",3.14#/□' Structural Grating
2'-11"×6'-0",3.14#/□' Structural Grating
Lock
2-3×3×¼ PL (Welded to Top of Angle)
Ls 2½×2½×3/8 (Frame) (Typ.)
Top of Slab
3 5/32
2" (Typ.)
L3×2×3/8 (Typ.)
2-3/8×1'-3"@18" Welded (Typ.)
Face of Wall
8'-0"

SECTION G G

Scale: 1"=1'-0"

Post shall be installed in accordance with Section 23 of the Standard Specifications Bid Item ⑯


2'-11"
¼"
¼"
2'-11"
2'-11"×6'-0",3.14#/□' Structural Grating
Hinge (Welded)
Ls 2½×2½×3/8 (Typ.)
Top of Wall
3 5/32
S4×7.7
L3×2×3/8 anchored @12"
2" (Typ.)
Face of Wall
Face of Wall
2'-10½"
6"
6'-8"

SECTION H H

Scale 1"=1'-0"

NO	DATE	REVISION	APPR
①	10/17/15	Added Const. Jt. with Wat. stop "AS BUILT"	[illegible]

SUBMITTED Rodney V. Houseal PROFESSIONAL

APPROVED J. L. McHenry CHIEF DIVISION OF RECREATIONAL FACILITIES

APPROVED DuPerrez DIRECTOR BUREAU OF DESIGN

RODNEY VINCENT HOUSEAL

1 1978

PROJ. NO.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
OFFICE OF RESOURCES MANAGEMENT

PROJECT NO. R14.31

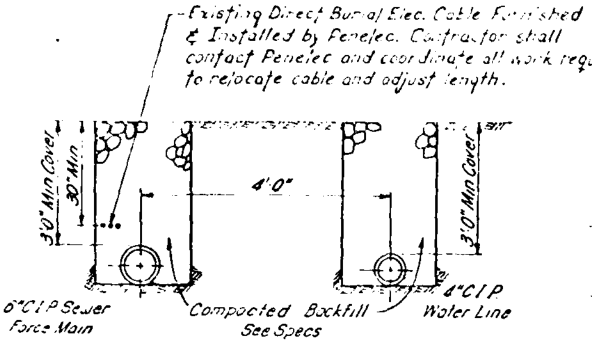
KEPHART DAM
BLACK MOSHANNON STATE PARK
CONSTRUCTION
BLACK MOSHANNON CREEK - CENTRE COUNTY

BERGER ASSOCIATES, INC.
Consulting Engineers
P.O. Box 1943 Harrisburg, Pa

WALL AND CONTROL
TOWER DETAILS

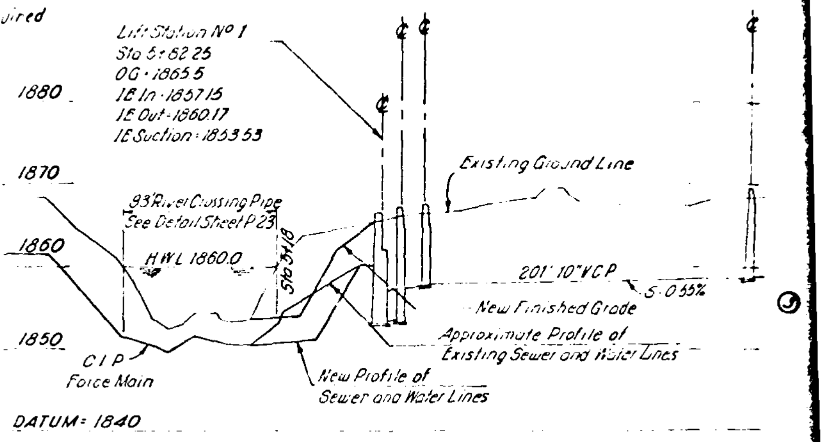
DRAWN BY JF DATE Dec. 1973
CHECKED BY TBB SCALE As shown

FIGURE 7


-Existing Direct Burial Elec. Cable Furnished & Installed by Penelec. Contractor shall contact Penelec and coordinate all work required to relocate cable and adjust length.
3'0" Min Cover
30" Min.
4'0"
3'0" Min Cover
6"C I P Sewer Force Main
Compacted Backfill See Specs
4"C I P Water Line

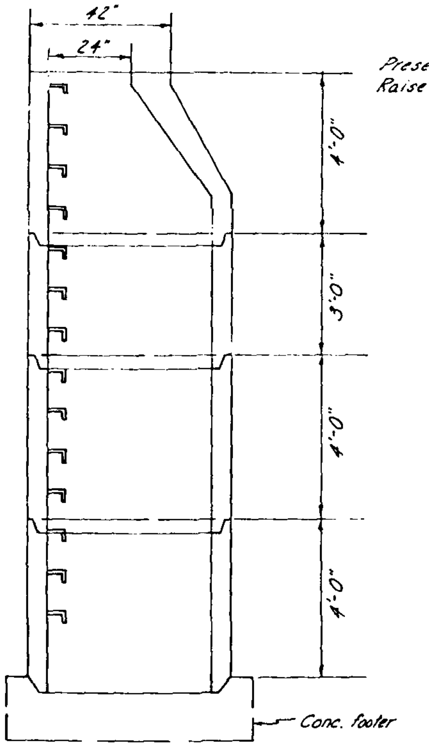
LAKE AND STREAM CROSSING DETAIL

No Scale

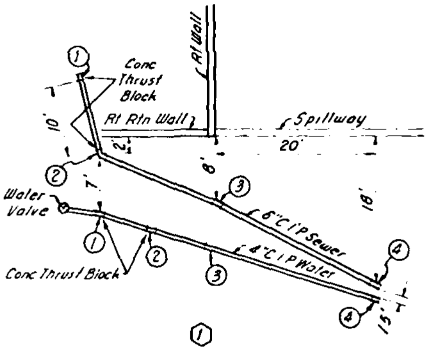

Lift Station Nº 1
Sta 5+82.25
OG - 1865.5
IE In - 1857.15
IE Out - 1860.17
IE Suction - 1853.53
1880
1870
1860
1850
93' River Crossing Pipe See Detail Sheet P 23
HWL 1860.0
Sta 5+18
Existing Ground Line
201' 10" VCP
S-0.55%
New Finished Grade
Approximate Profile of Existing Sewer and Water Lines
New Profile of Sewer and Water Lines
C I P Force Main
DATUM = 1840
①

PROFILE - SEWER "MAIN LINE"

① See "As Built" Detail below for new profile of sewer and water lines


42"
24"
Present EL. 1867.6
Raise to EL 1874.1
4'-0"
3'-0"
4'-0"
4'-0"
Conc. footer

SECTION ELEVATION - MANHOLE M-2
STATION 1+73, 12' Lt. of Const. ℄


Conc Thrust Block
Rt Wall
Rt Rtn Wall
Spillway
20'
10'
2'
7'
8'
18'
15'
Water Valve
6" C I P Sewer
4" C I P Water
Conc Thrust Block
①
②
③
④
①
②
③
④

①

PLAN

"AS BUILT" RELOCATION OF SEWER & WATER LINES (East Slope - Downstream from Spillway) Not to Scale

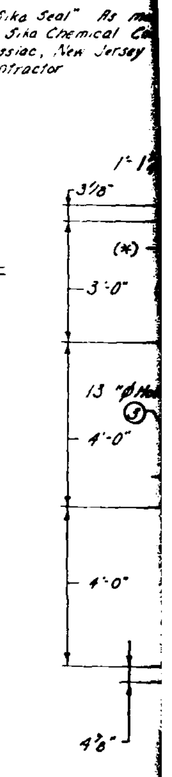
ITEMS

6" C I P SEWER LINE

① - Vert Bend - Elev 1858.5
② - Elbow - Elev 1855
③ - Splice
④ - Splice - Elev 1851

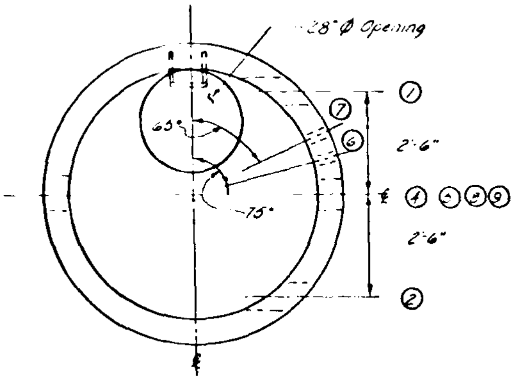
4" C I P WATER LINE

① - Vert Bend Elev 1861
② - Vert Bend Elev 1853
③ - Splice
④ - Splice - Elev 1851

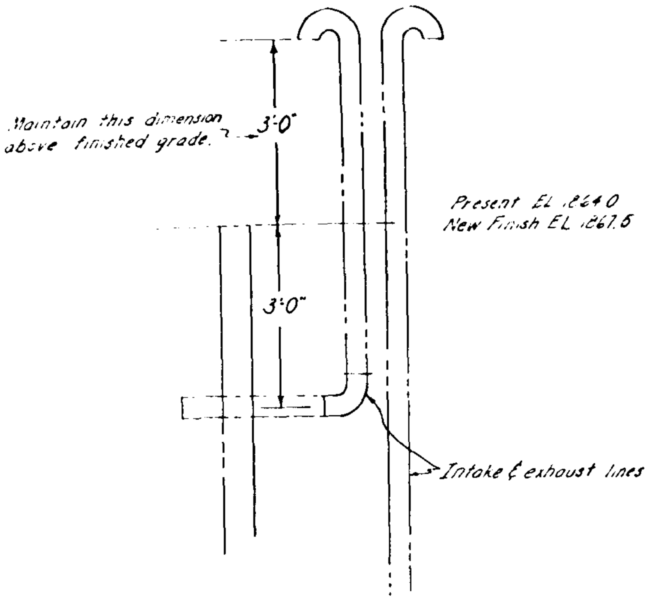

(X) "Sika Seal" As m
by Sika Chemical C
Passiac, New Jersey
Contractor
1'-1
3½"
(*)
3'-0"
13 "ØHo
4'-0"
4'-0"
4⅞"
③

Standard Manhole Supplier
Warren Concrete Products, Inc.
1911 Pennsylvania Avenue West
Warren, Pennsylvania 16365
Keystone Monobase Precast
Concrete Manholes
A.S.T.M. C-478

All Work shown on this Drawing to be paid for under Item Nº 18.

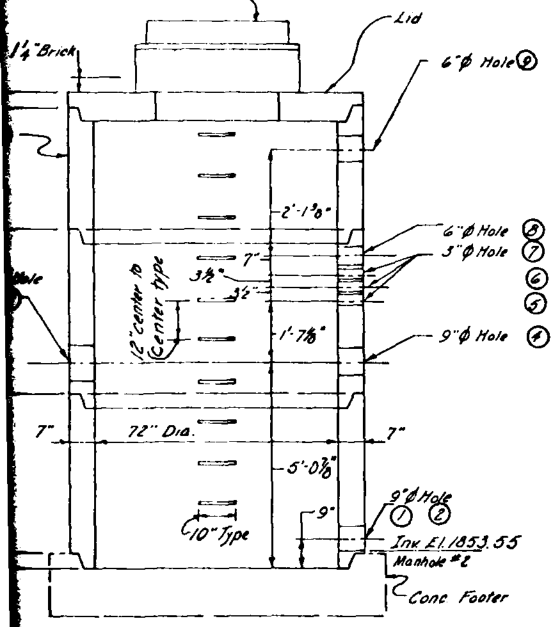

28" Ø Opening
65°
75°
⑦
⑥
①
2'-6"
℄ ④ ③ ⑧ ⑨
2'-6"
②
℄

PLAN WET WELL #1


Maintain this dimension above finished grade.
3'-0"
Present EL 1864.0
New Finish EL 1867.5
3'-0"
Intake & exhaust lines

WET WELL VENT PIPES
Station 1+86 , 14' Rt. Const. ℄

anufactured
Corporation,
Applied by


Present El. 1866.6
Raise to El. 1869.6
Lid
1¼" Brick
6" Ø Hole ⑨
2'-1⅜"
6" Ø Hole ⑧
3" Ø Hole ⑦
⑥
⑤
7"
3½"
3½"
12" center to Center type
1'-7⅛"
9" Ø Hole ④
7"
72" Dia.
7"
5'-0⅞"
9" Ø Hole
① ②
9"
10" Type
Inv. El. 1853.55
Manhole #2
Conc. Footer

SECTION ELEVATION EXISTING WET WELL
STATION 1+85, 10' Rt. of Const. ℄

ITEMS

① 6" Suction Line - 9" dia hole
② 6" Suction Line - 9" dia. hole
③ 8" Inlet Line - 13" dia. hole
④ 6" Outlet - 9" dia. hole
⑤ ¾" Service Vent Fan Line
⑥ ¾" Level Control Line
⑦ 1¼" Discharge Line
⑧ 4" Intoke Line
⑨ 4" Exhaust Line

Wet Well Supplier
New Enterprise Stone & Lime Co., Inc.
Concrete Products Division
Manufactured to meet A.S.T.M. Spec. C-478

"All Dimensions and Existing Conditions shall be checked and ve[illegible] by Contractor at the Site."

NO	DATE	REVISION	APPR
①	10 17 75	Plan-Sewer & Water Line Reloc. "AS BUILT"	WA

SUBMITTED
PROFESSIONAL

APPROVED
J. L. McNaney
CHIEF - DIVISION OF RECREATIONAL FACILITIES

APPROVED
DuPerrez
DIRECTOR - BUREAU OF DESIGN

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
OFFICE OF RESOURCES MANAGEMENT

PROJECT NO. R14:3.1

KEPHART DAM
BLACK MOSHANNON STATE PARK
CONSTRUCTION
BLACK MOSHANNON CREEK - CENTRE COUNTY

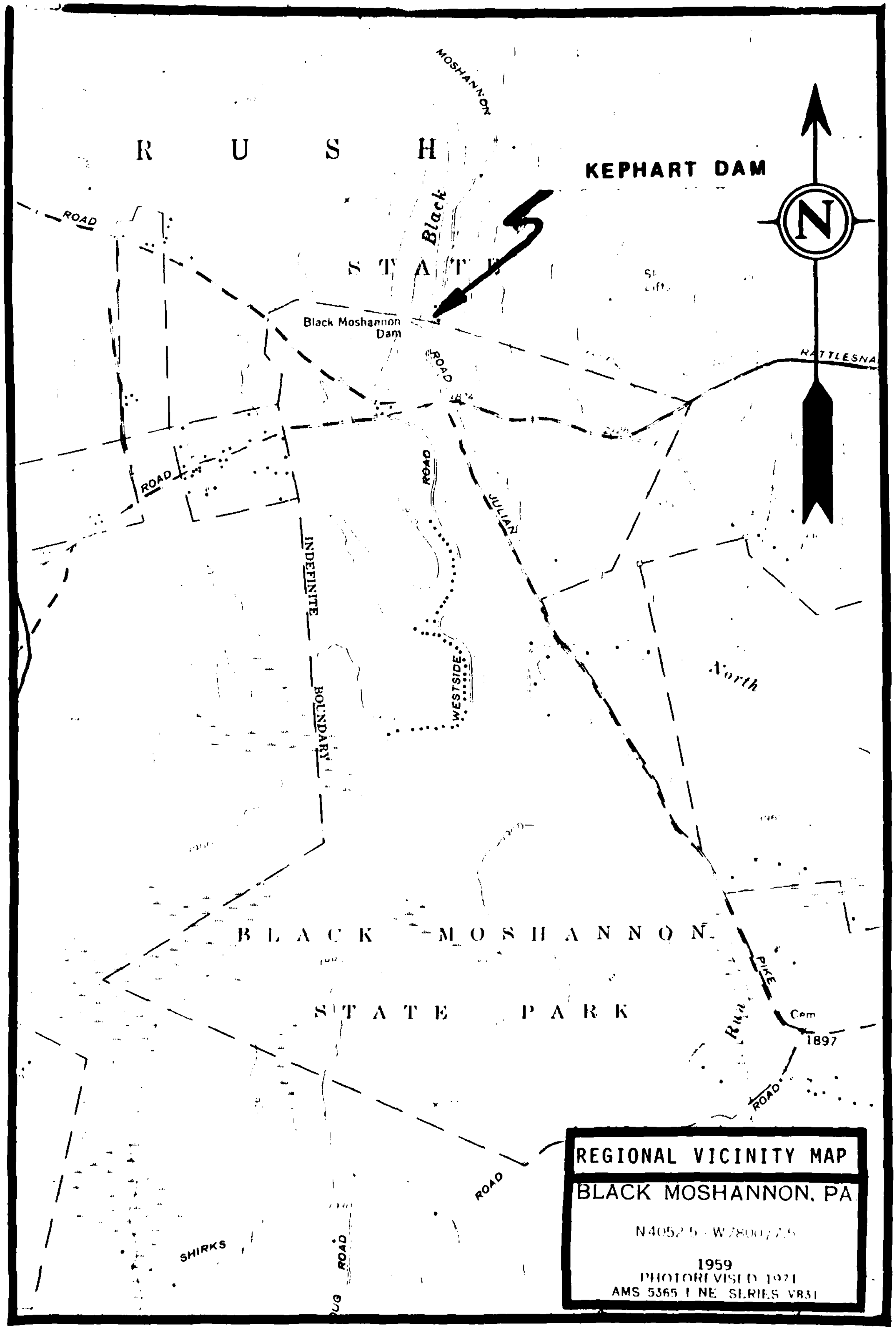
BERGER ASSOCIATES, INC.
Consulting Engineers
PO Box 1943 Harrisburg, Pa

MODIFICATION OF
UTILITIES

DRAWN BY	DATE	
JHH	Dec. 1973	**FIGURE 8**
CHECKED BY	SCALE	
E.M.L.	As shown	

APPENDIX G

REGIONAL VICINITY MAP
AND
WATERSHED BOUNDARY MAP


MOSHANNON
R U S H
KEPHART DAM
N
Black
S T A T E
Black Moshannon Dam
ROAD
ROAD
RATTLESNA
ROAD
ROAD
JULIAN
INDEFINITE
BOUNDARY
WESTSIDE
North
B L A C K M O S H A N N O N
S T A T E P A R K
PIKE
Run
Cem
1897
ROAD
ROAD
SHIRKS
ROAD

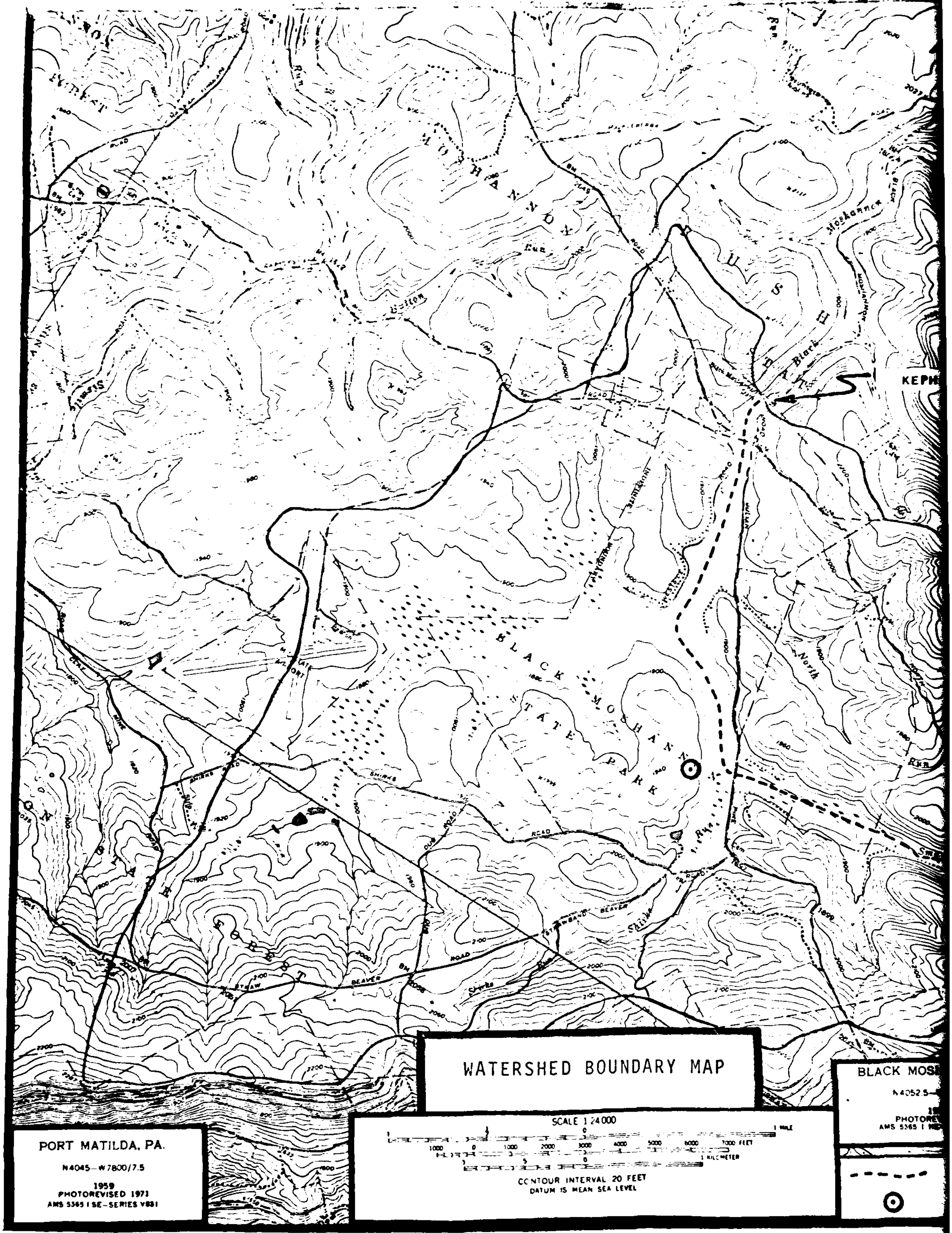
REGIONAL VICINITY MAP

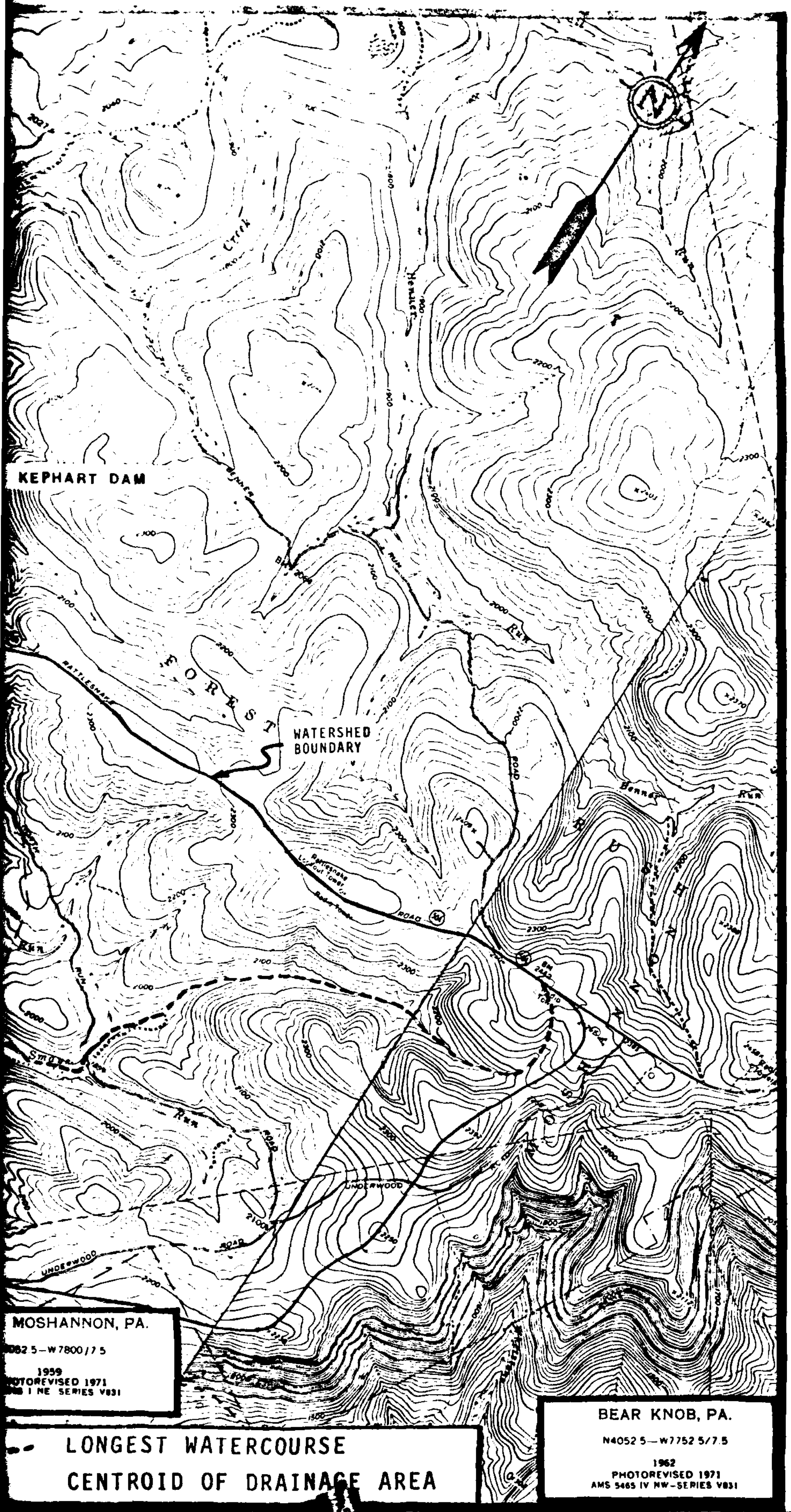
BLACK MOSHANNON, PA

N4052.5 - W7800/7.5

1959
PHOTOREVISED 1971
AMS 5365 I NE SERIES V831

WATERSHED BOUNDARY MAP


MOSHANNON
BLACK MOSHANNON STATE PARK
STATE FOREST
Black Moshannon
North Run
Shirks Road
Beaver Road
KEPH
SCALE 1 24000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
PORT MATILDA, PA.
N4045—W7800/7.5
1959
PHOTOREVISED 1971
AMS 5365 I SE—SERIES V831
BLACK MOS
N4052.5—
PHOTORE
AMS 5365 I N


N
KEPHART DAM
FOREST
WATERSHED BOUNDARY
Rattlesnake Lookout Tower
RATTLESNAKE
ROAD
Creek
Run
Benner Run
Smays Run
UNDERWOOD ROAD
UNDERWOOD
2100
2200
2300
MOSHANNON, PA.
N4052.5—W7800/7.5
1959
PHOTOREVISED 1971
AMS 5465 I NE SERIES V831
BEAR KNOB, PA.
N4052.5—W7752.5/7.5
1962
PHOTOREVISED 1971
AMS 5465 IV NW—SERIES V831
LONGEST WATERCOURSE
CENTROID OF DRAINAGE AREA